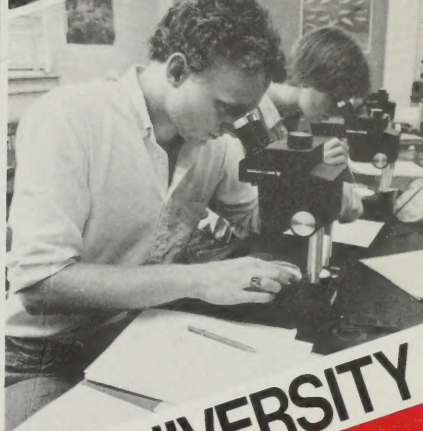


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NORTH CAROLINA STATE UNIVERSITY

NCSU #1



NORTH CAROLINA STATE UNIVERSITY

1983-1984

UNIVERSITY
DIRECTORY



1983-1984 UNIVERSITY DIRECTORY

University Exchange 737-2011

Emergency Numbers

Police, Fire, Ambulance, Emergency	3333
Medical Aid—Call Infirmary	2564
or Rex Hospital	755-3100
Accidents involving radioactive materials—	
Call	2894
Nights, Saturdays, Sundays or holidays	833-1244 or 787-8637
Physical Plant (during working hours)—	
To report malfunctions and breakdowns	
Control Center	2991

STATE TELECOMMUNICATIONS NETWORK

Calls to any point in the 48 states may be economically made on official business in this system.

Dial 8—area code—seven digit number.

Conference Calls (In the Continental U.S. only): Up to 10 parties can be included by dialing 733-1110 and giving the operator required information. **Very**

Important: Advance notice must be sent to each party so they will be available.

Rates: 12¢ per minute, in state

30¢ per minute, out of state

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CENTREX TELEPHONE INSTRUCTIONS

If after reading the following instructions you require further assistance, please dial 780-2711. Call the same number to report a telephone which is not operating properly.

INCOMING CALLS

Direct local outside calls to campus numbers may be made by dialing 737 plus the four-digit extension number. When the number is not known, callers will receive assistance by dialing the University exchange, 737-2011.

LOCAL CALLS

To other Centrex telephones—Dial the four-digit number listed in this directory.

To Raleigh telephones—Dial "9" plus the seven-digit number listed in the Raleigh Telephone Directory.

To student residence halls—Dial "9" plus the seven digit number.

LONG DISTANCE CALLS

Long distance calls will be charged to your CENTREX telephone number.

Station to Station (Direct) Dial 8—area code—seven digit number.

Person to Person, Credit Card and/or Charge to Third Number Dial 9—0—area code (if not 919)—seven digit number. Operator will then answer and assist call.

TO TRANSFER CALLS

Remain on the line, depress the receiver plunger once for one second and release. Listen for dial tone, dial campus number desired. Stay on line until number answers, announce call and hang up.

TO CONSULT PRIVATELY

Depress the plunger for one second and release. Listen for dial tone, dial campus number desired. Calling party cannot hear conversation. When consulting party hangs up, you are automatically reconnected to initial caller.

THREE PARTY CONFERENCE

To add another number to an existing conversation, depress plunger for one second and release, dial number desired. When the number answers, depress plunger and release. You have a 3-party conversation.

DIRECTORY AND INFORMATION CHANGES

Advise the chief operator (dial "O") immediately of all personnel changes affecting CENTREX telephone numbers so that the listings will always be current.

TELEPHONE EQUIPMENT CHANGES

The following procedure will be used for approval of orders for additions or changes in telephone equipment.

1. To secure technical information prior to submitting a request, department heads may contact the Telephone Company Business Office.
2. The department head will then prepare a letter in duplicate to the Office of Business Affairs, Attention: Mrs. Olive Stone, 112 Winston, setting forth the specific changes or additions in equipment which are desired. This letter must designate the availability and source of funds to pay for the service requested.
3. The Supervisor of Telephone Services will process the order with the Telephone Company and the Physical Plant office after it has been determined that funds, in fact, are available to support the request.

The Office of Business Affairs insists that the budget adjustments necessary to support additional telephone service be submitted and approved in writing prior to initiation of the service order to the Telephone Company.



NORTH CAROLINA STATE UNIVERSITY **ADMINISTRATION**

Chancellor	Bruce R. Poulton	A Holladay	2191, 2192
Provost and Vice Chancellor	Nash N. Winstead	109 Holladay	2195
Vice Provost and Dean of the Graduate School	Jasper D. Memory	103 Peele	2394
Vice Provost and Dean for Research	Henry B. Smith	208 Daniels	2117
Vice Chancellor for Extension and Public Service	W. L. Turner	200 McKimmon	2144
Vice Chancellor for Finance and Business	George Worsley	B Holladay	2155
Vice Chancellor for Foundations and University Relations	Rudolph Pate	12 Holladay	2846
Interim Vice Chancellor for Student Affairs	Thomas H. Stafford Jr. ..	101 Holladay	2446, 2447
Secretary of the University	William H. Simpson	A Holladay	2200
University Counsel	Clauston L. Jenkins Jr. ..	A Holladay	2319
Assistant to the Chancellor for Policy and Planning	Karen Peterson	A Holladay	3062

DEANS OF THE SCHOOLS

Agriculture and Life Sciences	J. E. Legates	112 Patterson	2668
Design	Claude E. McKinney	200-A Brooks	2201
Education	Carl J. Dolce	208-C Poe	2231, 2232
Engineering	Larry K. Monteith	109 Page	2311, 2312
Forest Resources	Eric L. Ellwood	2028-H Biltmore	2883, 2884
Humanities and Social Sciences ..	Robert O. Tilman	106 Link	2467
Physical and Mathematical Sciences	Garrett Briggs	122 Cox	2501, 2502
Textiles	Dame S. Hamby	101 Nelson	3231
Veterinary Medicine	T. M. Curtin	4700 Hillsborough St.	829-4210

THE UNIVERSITY OF NORTH CAROLINA

GENERAL ADMINISTRATION

Chapel Hill	
Central Telephone	919-962-6981
President	William C. Friday
Vice President—Academic Affairs	Raymond H. Dawson
Vice President—Research and Public Service Programs	E. Walton Jones
Vice President—Finance	L. Felix Joyner
Vice President—Planning	Roy Carroll
Vice President—Student Services and Special Programs	Cleon F. Thompson Jr.
Secretary of the University	John P. Kennedy Jr.
Assistant to the President	Arnold K. King
(for Relations with Faculty, Assembly, Private Colleges and Universities, and the Community College System)	
Assistant to the President	Roscoe D. McMillan Jr.
(for Governmental Affairs)	
Assistant to the President	Richard H. Robinson Jr.
(for Legal Affairs)	
Assistant to the President	Trudy Atkins
(for Public Relations)	

NCSU BOARD OF TRUSTEES

Roderick D. Adams
Durham, N. C.

Wallace J. Conner
Newport, N. C.

Marcus B. Crotts
Winston-Salem, N. C.

James A. Hackney III
Washington, N. C.

Jack P. Jordan
Mt. Gilead, N. C.

Elizabeth B. Lee
Lumberton, N. C.

Roy H. Park
Ithaca, N. Y.

Edward I. Weisiger
Charlotte, N. C.

T. Baxter Williams Jr.
Currituck, N. C.

Allen Wiser
Raleigh, N. C.

George M. Wood
Camden, N. C.

James L. Yocum
4130 Univ. Student Ctr.

William H. Simpson, Asst. Sec.
A Holladay Hall—737-2200

SCHOOLS, DEPARTMENTS, DIVISIONS AND OFFICES

A

Office	Head	Address	Phone
Academic Skills Program			
Director	Hugh Fuller	300-D Poe	3592
Academic Advancement	Thomas Conway	200 Harris	3533
Academic Advancement For Stu. Athletes	Joe Brown	124 Reynolds Coliseum...	2464, 3680
Academic Support Services	Brenda Allen	528-A Poe	3163
Accounting			
Director	Ernest G. Murphrey	7 Holladay	3824
Mgr., General Accounting		9 Holladay	3823
Supv., Accounts Payable	Deborah P. Lane	1 Holladay	2158
Supv., Fund Accounting	Lou F. Rosendahl	1 Holladay	2149
Supv., Travel Audit	Brenda G. Burnett	1 Holladay	3497
Mgr., Spec. Accounting Serv.	Billy R. Bunn	10 Holladay	2148
Supv., Capital Assets Accounting	L. Mark Woodlief	10 Holladay	2148
Mgr., Payroll & Benefits	Ruth Ellis	Leazar Lower Level	2151
Supv., Payroll	Henry J. Beeker Jr.	Leazar Lower Level	2151
Supv., Benefits	Neil J. Pait	Leazar Lower Level	2151
Accounting, Academic Programs	C. J. Messere	203 Patterson	3273
Administrative Computing Services			
Director	H. Leo Buckmaster	B-21 Hillsborough Bldg.	2794
Admissions			
Director	Anna P. Keller	112 Peele	2437
Assoc. Dir.	George R. Dixon	112 Peele	2437
Asst. Dir.	Reginald Fennell	112 Peele	2437
Asst. Dir.	Rhonda J. Huffman	112 Peele	2437
Asst. Dir.	E. Louise Justice	112 Peele	2437
Adult and Community College Education			
Head	E. J. Boone	117 Ricks	2707
Affirmative Action Officer & Compliance			
Officer for Title IX	Lawrence M. Clark	201 Holladay	3148
Agricultural Communications			
Head	D. M. Jenkins	118 Ricks	2800, 2804
Educational Media Center		2317 Library	3971
Press, Radio, TV		314 Ricks	3173
Publications		318 Ricks	3173
Service Section		G-5 Ricks	2791
Visual Communications		G-1 Ricks	2861
Agricultural Economics, Economics & Business			
Agr'l Res. & Coord. of Advising	R. K. Perrin	220-C Patterson	2608
Extension	T. E. Nichols Jr.	212 Patterson	3107
Agricultural Education; Occupational Education			
Coordinator	L. R. Jewell	602-M Poe	2234
Agricultural Institute			
Director	H. Bradford Craig	107 Patterson	3248
Agricultural Research Service	D. F. Bateman	100-B Patterson	2718
Agriculture and Life Sciences, School of			
Dean	J. E. Legates	112 Patterson	2668, 2641
Business Officer	R. W. Gay Jr.	120 Patterson	2710
Academic Affairs			
Assoc. Dean & Dir.	E. W. Glazener	115 Patterson	2614, 2615
Assoc. Dir.	H. Bradford Craig	107 Patterson	3248
Acad. Adv. & Place.	R. E. Parries	111 Patterson	3249
Agricultural Extension Service			
Assoc. Dean & Dir.	C. D. Black	104 Ricks	2811, 2812
Assoc. Dir.	R. C. Wells	106 Ricks	2812, 2811
Asst. Dir., Agri. & Spec. Prog.	D. G. Harwood	302 Ricks	3252
Asst. Dir., Comm. & Rural Dev.	J. A. Phillips	216 Ricks	3467

Office	Head	Address	Phone
Asst. Dir., County Operations	P. E. Dew	108 Ricks	2813
Asst. Dir., 4-H & Youth Dev.	D. L. Stormer	201 Ricks	2801, 3242
Asst. Dir., Home Econ.	Martha R. Johnson	107 Ricks	2781
Asst. Dir., Training	E. J. Boone	117 Ricks	2707
Ext. Personnel Dev. Spec.	M. A. Davis	109 Ricks	2814
Agricultural Research Service			
Assoc. Dean & Dir.	D. F. Bateman	100-B Patterson	2718
Assoc. Dir., Intl. Prog.	J. L. Apple	209 Daniels	2665, 3201
Assoc. Dir.	George J. Kriz	100-C Patterson	2719
Asst. Dir.	E. B. Cowling	2028 Biltmore	2883, 2884
Asst. Dir.	W. H. Johnson	100-D Patterson	2717
Asst. Dir.	C. E. Stevens	4700 Hillsborough St.	829-4312
Agromeck			
Editor	Marc Whitehurst	3123 Univ. Stu. Ctr.	2409
Air Force ROTC	Col. Donald Nash	145 Reynolds Coliseum	2417
Alumni Relations			
Director	Bryce R. Younts	Alumni Bldg.	3375
Assoc. Dir.	Albert B. Lanier Jr.	Alumni Bldg.	3375
Asst. Dir.	Beth A. McGee	Alumni Bldg.	3375
Editor	Jeri Gray	Alumni Bldg.	3375
Animal Science			
Head	C. A. Lassiter	123 Polk	2755, 2756
Animal-Forage Metabolism Complex		Trenton Rd.	851-1803
Dairy Records Proc. Ctr.		Leazar	2632
Ext. Animal Husbandry	J. W. Patterson	117 Polk	2761, 2762
Ext. Dairy Husbandry	F. N. Knott	102 Polk	2771, 2772
Ext. Swine Husbandry	J. R. Jones	201 Polk	2566
Grinnells Animal Health Lab		Western Blvd.	3319
Reproductive Physiology Research Lab.		1400 Blue Ridge Blvd.	2673, 3849
Teaching Coordinator	R. M. Myers	225 Polk	2764
Architecture Program			
Acting Director	Robert P. Burns	222 Brooks	2204, 2205, 2206
Archives	Maurice S. Toler	G-111 Library	2273
Army ROTC	Lt. Col. Martin S. Anderson	160 Reynolds Coliseum	2428
Art			
Curator	Charlotte V. Brown	4110 Univ. Stu. Ctr.	3503
Athletics			
Director	Willis R. Casey	Case Athl. Center	2109
Assoc. Dir.	Frank Weedon	Case Athl. Center	2560
Asst. Dir.	Nora Lynn Finch	122 Reynolds Coliseum	2880
Asst. Dir.	Kevin O'Connell	Case Athl. Center	2101
Asst. Dir.	Robert A. Robinson	Case Athl. Center	2101
Asst. to the Dir.	Howard Hink	Cast Athl. Center	3476
Asst. to the Dir.	Ray Tanner	103 Reynolds Coliseum	2106
Box Office Mgr.	Bessie Steele	103 Reynolds Coliseum	2106
Business Mgr.	Richard Farrell	103 Reynolds Coliseum	3475
Coliseum Engineer	Bobby Stocks	106 Reynolds Coliseum	2108
Equipment Manager	Dorsey Poole	Weisiger-Brown Athl. Fac.	3956
Head Trainer	Craig Sink	Weisiger-Brown Athl. Fac.	3960
Sports Information Dir.	Ed Seaman	Case Athl. Center	2102
Wolfpack Club Dir.	Charlie Bryant	College Inn	2112
Baseball	Sam Esposito	Case Athl. Center	3476
Basketball, Men's	James T. Valvano	Case Athl. Center	2104
Basketball, Women's	Kay Yow	Case Athl. Center	2880
Cross Country, Men's & Women's	Rollie Geiger	Reynolds Coliseum	3455
Fencing, Men's & Women's	Steven Andreus	Case Athl. Center	3476
Football	Tom Reed	Weisiger-Brown Athl. Fac.	2114
Golf, Men's	Richard Sykes	Case Athl. Ctr.	2101
Golf, Women's	Fran Allen	Wilmar Golf Club	266-1800
Gymnastics, Men's & Women's	Mark Stevenson	Case Athl. Center	3476
Rifle, Men's & Women's	John Reynolds	(after 5:00 p.m.)	872-0544
Soccer, Men's & Women's	Larry Gross	Case Athl. Center	2101
Swimming, Men's	Don Easterling	Case Athl. Center	2101
Swimming, Women's	Bob Wiencken	Case Athl. Center	2101
Tennis, Men's & Women's	Crawford Henry	122 Reynolds Coliseum	2493

Office	Head	Address	Phone
Track	Tom Jones	Weisiger-Brown Athl. Fac.	3959
Volleyball	Judy Martino	Case Athl. Ctr.	2880
Wrestling	Bob Guzzo	Weisiger-Brown Athl. Fac.	3959
Audit Div. (Internal), Mgr.	Preston Bethea	B Holladay	3289

B

Biochemistry			
Head	Samuel B. Tove	126 Polk	2581
Biological and Agricultural Engineering			
Head	F. J. Hassler	100 Weaver	2694
Ext. Bio. & Agri. Engr.	Frank J. Humenik	200 Weaver	2675
Biological Sciences Interdepartmental			
Teaching Program Coordinator	C. F. Lytle	2717-A Bostian	3341
Biomathematics (See Statistics)			
Botany			
Head	Jerome P. Miksche	2214 Gardner	2727
Grad. Administrator	Tommy E. Wynn	2717-B Bostian	3341
Herbarium	James Hardin	3207 Gardner	2700
Budgets			
Director	Roy L. Holley	206 Holladay	2175
Building Services		3 Park Shops	3323
Business Data Processing			
Director	W. Jerry Pounds	14 Peele	2459
Manager	Graham Campbell	11 Peele	2459

C

Campus Planning and Construction			
Director/Univ. Architect	Edwin F. Harris Jr.	Basement, Watauga	2121
Univ. Construction Mgr.	John G. Fields	Basement, Watauga	2121
Univ. Landscape Architect	G. Judson Newbern	Basement, Watauga	2121
Consulting Architect	W. Huntley McKinnon	Basement, Watauga	2121
Admn. Asst.	Martha M. Welch	Basement, Watauga	2121
Capital Assets Accounting Supv.	L. Mark Woodlief	10 Holladay	2148
Career Planning and Placement Center			
Director	Walter B. Jones	28 Dabney	2396
Carter-Pinley Stadium .....		.....	2215, 2218
Central Stores			
Supervisor	J. L. Barbour	Central Stores	2198
Sales Dept.	Arthur Bradford	Central Stores	2230
Accts. Rec.	Barbara Byrd	Central Stores	2197
Central Receiving	Joe Greene	Central Stores	2211
Freight Office	Ray Lawhorn	Central Stores	2211
Gas Cylinder Mgmt.	Sam Cotton	Central Stores	2211
Chancellor's Office			
Chancellor	Bruce R. Poulton	A Holladay	2191, 2192
Univ. Counsel	Clauston L. Jenkins Jr.	A Holladay	2319
Sec. of the Univ.	William H. Simpson	A Holladay	2200
Assistant to the Chancellor			
for Policy and Planning	Karen Peterson	A Holladay	3062
Admn. Asst.	Thomasene F. Bennett	A Holladay	2191
Chemical Engineering			
Head	H. B. Hopfenberg	113 Riddick	2324
Grad. Admin.	R. M. Felder	316 Riddick	3571
Undergrad. Admin.	M. R. Overcash	317 Riddick	2325
Chemistry			
Acting Head	Kenneth W. Hanck	108-A Dabney	2545
Asst. Head, Facilities &			
Business Affairs	Marion Miles	525 Dabney	2941
Asst. Head, Graduate Studies ...	Charles G. Moreland	108 Dabney	2548

Office	Head	Address	Phone
Asst. Head, Undergrad. Studies	Forrest C. Hentz	208 Dabney	2546
Supply Room	Curtis G. Harris	314 Dabney	2547
Civil Engineering			
Head	Paul Zia	208 Mann	2352
Asst. Head	H. R. Malcom	211 Mann	2331
Grad. Admin.	Harvey E. Wahls	201 Mann	2331
Ctr. for Transportation			
Engr. Studies	Paul Zia	208 Mann	2331
Climatologist, Office of the State		123 Kilgore	3056
Coliseum, Reynolds			
Director	Willis R. Casey	Case Athl. Center	2109
Box Office Mgr.	Bessie Steele	103 Reynolds Coliseum	2106
Concessions Dir., SSS	Wiley L. Gouge	119 Reynolds Coliseum	2123
Computer Science			
Head	Donald C. Martin	122 Daniels	2858
Undergrad. Admin.	Alan L. Tharp	131-K Daniels	2858
Undergrad. Coord.	Joyce Hatch	121 Daniels	2858
Graduate Admin.	David F. McAllister	122 Daniels	2858
Computer Studies (Grad. Prog.)			
Director	Wushow Chou	318 Daniels	2654
Assoc. Director	David F. McAllister	122 Daniels	2654
Computing Center			
Director	Carl W. Malstrom	M-2 Hillsborough Bldg.	2517
Asst. Dir.	J. Carl Allred	107 Hillsborough Bldg.	2517
Administrative Serv.	Betty Strickland	M-2 Hillsborough Bldg.	2517
Business Serv.	Bonnie Hine	109 Hillsborough Bldg.	2517
Communications & Hardware Serv.	Sam Averitt	104 Hillsborough Bldg.	2517
Operations	George Stancil	105 Hillsborough Bldg.	2517
Systems	Larry Roberson	124 Hillsborough Bldg.	2517
User Serv.	W. Darrell Myrick	B17G Hillsborough Bldg.	2517
Consulting		106 Hillsborough Bldg.	3035
Dispatching		126 Hillsborough Bldg.	2523
General Info.		M-2 Hillsborough Bldg.	2517
Burlington Res. Terminal		1132 Burlington Lab	3165
Daniels Terminal		118 Daniels	3631
Computing Center, Triangle Universities (TUCC) (See Triangle Universities Computation Center)			
Computing Facility, Educ.		424 Poe	2681
Concessions and Vending, Students Supply Stores			
Dir.	Wiley Gouge	119 Reynolds Coliseum	2123
Continuing Education, Division of			
Acting Director	Kelly R. Crump	147-I McKimmon	3007
Assoc. Dir.	David B. Stansel	225 McKimmon	2277
Asst. Dir. (Credit Branch)	John F. Cudd Jr.	145-C McKimmon	2265
Asst. Dir. (Short Courses & Conf.)	Kelly R. Crump	147-H McKimmon	2261
Contracts and Grants Director			
Director	Earl N. Pulliam	3 Leazar Lower Level	2153
Asst. Dir.	Bill E. Kent	3 Leazar Lower Level	2154
Cooperating Raleigh Colleges			
Director	Rosalie P. Gates	Johnson Hall	833-6461
		Meredith College	
Cooperative Campus Ministry			
Assemblies of God	Raymond U. Sowell	P.O. Box 566	876-6142
Baptist	Hank Greer	Baptist Stu. Ctr.	834-1875
	Ted Purcell	Baptist Stu. Ctr.	834-1875
Catholic	Father Alan Dash	1200 Univ. Stu. Ctr.	2414
Episcopal	Jacqueline Schmitt	1200 Univ. Stu. Ctr.	2414
Intra-Varsity	Katie Rawson	624-C Smithdale Rd.	851-8813
Jewish	Rabbi Martin Beifield	5315 Creedmoor Rd.	781-4895
		27612	
Lutheran	Tom Nelson	P.O. Box 10351	828-1433
Methodist	Joe Mann	2501 Clark Ave.	833-1861
Metropolitan Community Church	June Norris	P.O. Box 5626, 27650	834-2611
Moravian	Hal Durham	3225 Darien Dr.	787-4034
Presbyterian	W. W. Olney	27 Horne St.	834-5184
	Gail Phares	27 Horne St.	834-5184

Office	Head	Address	Phone
United Student Fellowship	Shelton Murphy	1105 Apt. 1-D Craborchard Dr.	851-0531
Coop. Sports Fishery Research			
Leader	M. T. Huish	4105 Gardner	2631
Counseling Center			
Director	M. Lee Salter	200 Harris	2423
Asst. Dir., Counseling	Michael E. Bachman	200 Harris	2423
Special Services			
Project Dir.	Thomas E. H. Conway Jr.	200 Harris	3533
Counselor Educ.			
Head	Norman A. Sprinthall	520 Poe	2244
Craft Center	Conrad W. Weiser	Thompson Bldg.	2457
Creamery	R. R. Earley	12 Schaub	2760
Credit Union, State Employees'			
Branch Manager	J. B. Neel	2802 Hillsborough St.	2686
Crop Improvement Association			
Director	Foil W. McLaughlin	3709 Hillsborough St.	2851
Crop Science			
Head	Billy E. Caldwell	2207 Williams	2647, 2648
Teaching Coord., Grad. and			
Undergrad. Programs	D. A. Emery	2210 Williams	3666, 3667
In Charge, Ext. Crop Science	G. L. Jones	2212 Williams	2653
Curator of Art	Charlotte V. Brown	4110 Univ. Stu. Ctr.	3503
Curriculum and Instruction Education			
Head	Barbara M. Parramore	402-S Poe	3221

D

Dairy (See Animal Science and Food Science)			
Dairy Plant	R. R. Earley	12 Schaub	2760
Design Fundamentals Program			
Director	Charles Joyner	221 Brooks	2204, 2205, 2206
Design Library	Maryellen LoPresti	209 Brooks	2207
Design, School of			
Dean	Claude E. McKinney	200-A Brooks	2201, 2202, 2208
Design Shop	Terry E. Frye	117 Brooks	2204
Dormitories (See Residence Halls)			
Duplicating Facility, Educ.	Carlton Driver	120 Poe	2231

E

Ecology Committee			
Chairman	E. D. Seneca	4219 Gardner	2129
Economics & Business			
Head	D. M. Hoover	201 Patterson	3273
Assoc. Head, Accounting	C. J. Messere	203-A Patterson	3951
Assoc. Head, Agri'l. Res. & Teaching	R. K. Perrin	220-C Patterson	3951
Assoc. Head, Econ. & Bus.	J. S. Lapp	203-B Patterson	3951
Assoc. Head & Ext. Specialist-in-Charge	M. A. Johnson	212 Patterson	3107
Asst. Head, Graduate Programs	M. B. McElroy	201-D Patterson	3273
Dir., Center for Econ. &			
Bus. Studies	B. M. Olsen	201-F Patterson	3273
Asst. to Head and Scheduling Off.	H. T. Daniel	204 Patterson	3273
Advisor/Counselor	Bobby Lee Puryear	201-G Patterson	3273
Economic and Business Studies, Center for			
Director	B. M. Olsen	201-F Patterson	3273
Education, School of			
Dean	Carl J. Dolce	208 Poe	2231
Assoc. Dean	Jonathan P. Sher	208 Poe	2231
Assoc. Dean	Robert T. Williams	208 Poe	2231
Dir., Information Systems Group	William L. Ballenger	424 Poe	2681

Office	Head	Address	Phone
Research and Extension Services	Carl J. Dolce	608 Poe	3127
Educational Leadership & Prog. Eval.	Bruce G. Beezer	608 Poe	3127
Electrical and Computer Engineering			
Head	N. A. Masnari	232 Daniels	3001
Assoc. Head, Undergrad. Admin.	W. T. Easter	232 Daniels	2336
Graduate Admin.	J. F. Kauffman	238 Daniels	2336
Coord., Advising	R. K. Ingle	233 Daniels	2336
Dir., Ctr. for Communications & Signal Processing	S. Chitsaz	320 Daniels	3015
Electron Microscopy Center	J. M. Mackenzie Jr.	1223 Gardner	2664
Endowment Fund of NCSU			
Director		B Holladay	2110
Energy and Environmental Programs			
Director	F. D. Hart	Page	3328
Engineering Design Center			
Director	W. C. Griffith	2405 Broughton	3224
Engineering Operations Program			
Director	John Ely	Page	2315
Engineering Research Services Division			
Director	F. D. Hart	Page	2345, 3328
Engineering, School of			
Dean	Larry K. Monteith	109 Page	2312
Dir., Admin. Services	Gilbert Hay	104 Page	2310
Assoc. Dean, Academic Affairs	Carl F. Zorowski	Page	2316
Assoc. Dean, Research Programs	Franklin D. Hart	Page	3328
Asst. Dean, Extension	John R. Hart	260 Page	3262
Asst. Dean, Undergrad.			
Academic Programs	John F. Ely	Page	2315
Asst. Dean, Undergrad.			
Student Services	George F. Bland	Page	3693
Dir., Continuing Services	Robert M. Turner	Page	3263
Dir., Special Services	Byard Houck	Page	2341
Coord., Co-operative Education	John Hamme	Page	2300
Coord., Minority Student Services	Bobby Pettis	Page	3693
Publications	Martha K. Brinson	Page, Ground Floor	2310
(For engineering departments, look under individual listing: Biological and Agricultural, Chemical, Civil, Electrical and Computer, Industrial, Materials, Mechanical and Aerospace, and Nuclear.)			
Engineering Writing Assistance			
Program	Gary Blank	Page	3545
English			
Dept. Office			3866
Head	Larry S. Champion	131-B Tompkins	2462
Asst. Head	Jack D. Durant	131-D Tompkins	3353
Asst. Head, Scheduling	Marilyn M. Brandt	131-F Tompkins	3353
Dir., Undergrad. Prog.	Allen F. Stein	121 Tompkins	3854
Dir., Freshman Prog.	Jack D. Durant	131-D Tompkins	3353
Dir., Graduate Prog.	Mary C. Williams	122 Tompkins	3854
English Education	Ruie Pritchard	408 Poe	3221
Entomology			
Head	Ronald J. Kuhr	2301 Gardner	2746
Ext. Entomology	R. L. Robertson	2309 Gardner	2703, 2831
Environmental Projects	David Adams	139 Harrelson	2490
Extension			
Vice Chancellor for Extension & Public Service	W. L. Turner	200 McKimmon	2144
Assoc. Vice Chan.	Grover J. Andrews	202 McKimmon	3373
Asst. to Vice Chan.	Mary Frances Hester	204-A McKimmon	3373

F

Faculty Club			
Manager	Harry E. Anderson	4200 Hillsborough St., 27606	828-0308

Office	Head	Address	Phone
Faculty Senate			
Chairman	M. Mohan Sawhney	2319 Library	2279
Fellows Program, North Carolina			
State	Gerald G. Hawkins	210 Harris	3151
Fiber and Polymer Science			
Program	William K. Walsh	107-B Nelson	3057
Film Library, Agricultural Extension		Ricks Annex	2861
Finance and Business			
Vice Chancellor, Fin. and Bus.	George Worsley	B Holladay	2155
Assoc. Vice Chancellor, Fin. and Bus.	William A. Jenkins	B Holladay	2732
Asst. Vice Chancellor, Bus.	Lauren J. Brisky	203 Holladay	2146, 2147
Asst. Vice Chancellor, Fin.	Darryl W. Bierly	B Holladay	2143
Financial Aid			
Director	Carl O. Eycke	213 Peele	2421, 2448
Assoc. Dir.	Paul D. West Jr.	213 Peele	2421, 2448
Counselor	Bertie S. Belvin	213 Peele	2421, 2448
Counselor	Jeanne M. Driggers	213 Peele	2421, 2448
Counselor	Florence I. Francis	213 Peele	2421, 2448
Counselor	Rhonda W. Huffman	212 Peele	2421, 2437
Counselor, Scholarship Coord.	Patricia J. Lee	205 Peele	3671
Counselor	Mary F. Usry	213 Peele	2421, 2448
Food Science			
Head	D. R. Lineback	100-C Schaub	2951
Teaching Coord., Grad. & Undergrad. Programs	V. A. Jones	100-D Schaub	2952
In Charge, Ext. Food Science	N. C. Miller Jr.	129-B Schaub	2956
Creamery	R. R. Earley	12 Schaub	2760
Foreign Languages and Literatures			
Dept. Office		126-A 1911 Bldg.	2475
Head	Alan A. Gonzalez	122 1911 Bldg.	3343
Asst. Head	Lina Cofresi	126 1911 Bldg.	2475
Scheduling Officer	Sofus Simonsen	129 1911 Bldg.	2475
Language Lab.	Edward M. Stack	302 Harrelson	3358
Teacher Educ.	Arlene Malinowski	113 1911 Bldg.	2475
Spanish/Business Prog.	Dario Cortes	131 1911 Bldg.	2475
Language Festival	Gilbert Smith	119 1911 Bldg.	2475
ESL Prog.	Virginia Prichard	304 Harrelson	3297
Forest Resources Library	Pamela E. Puryear	4012 Biltmore	3513
Forest Resources, School of			
Dean	Eric L. Ellwood	2028-H Biltmore	2883, 2884
Assoc. Dean, Acad. Aff.	LeRoy C. Saylor	2028-C Biltmore	2883
Assoc. Dean, Research	E. B. Cowling	2028-F Biltmore	2883
Forestry Extension, In Charge	Michael P. Levi	3036-D Biltmore	3386, 3387
Forestry			
Head	Arthur W. Cooper	2018-E Biltmore	2892
Foundation Seed Producers, Inc.			
Manager	R. W. McMillen	4025 Beryl Rd.	2821
Foundations Accounting & Investments			
Director	Paulette E. Jervay	B Holladay	2110
Foundations and Development			
Vice Chancellor	Rudolph Pate	12 Holladay	2846
Assoc. Vice Chancellor for Found. and Dev.	John T. Kanipe Jr.	12 Holladay	2846
Assoc. Vice Chancellor for Found. and Dev.	George E. Moore	Watauga	3030
Asst. Vice Chancellor for Spec. Serv.	Hardy D. Berry	20 Enterprise St.	3700
Director of Deferred Giving	Carol L. Hill	20 Enterprise St.	3700
Asst. Dir. of Found.	John A. Gehrm II	20 Enterprise St.	3700
Asst. Dir. of Found.	Richard J. Reiman	20 Enterprise St.	3700
Asst. Dir. of Found.	Ray Smith	11 Holladay	2846
Asst. Dir. of Found.	Robert N. Wood	12 Holladay	2846
Fraternities—Interfraternity Council			
President	Kurt Jetta	214 Harris	2441
Alpha Gamma Rho	George Snow	2304 Hillsborough St.	821-7410
		27607	

Office	Head	Address	Phone
Alpha Phi Alpha	Charles Lewis	2309-D Myron Rd., 27607 ..	782-4915
Alpha Sigma Phi	Paul Green	10 Enterprise St.	833-7291
		27607	
Delta Sigma Phi	Charles Young	Box 5566, 27607	772-9887
Delta Upsilon	Mike Janovich	3 Maiden Ln., 27607	834-9255
Farmhouse	Steve Woodruff	115 Park Ave., 27605	832-0886
Kappa Alpha	Bill McGuinn	2601 W. Fraternity Ct. ...	833-4271
		27606	
Kappa Alpha Psi	Leslie Jarvis	120-A Syme	5163
Kappa Sigma	Tom Calhoun	2613 W. Fraternity Ct. ...	832-3812
		27606	
Lambda Chi Alpha	Rick Bynum	108 S. Fraternity Ct.	832-5634
		27606	
Omega Psi Phi	Andrea Marks	214 Harris	2441
Phi Kappa Tau	Mike Wynne	2511 W. Fraternity Ct. ...	828-7625
		27606	
Pi Kappa Alpha	Ted Farley	214 S. Fraternity Ct.	828-7641
		27606	
Pi Kappa Phi	Jed Dale	2401 W. Fraternity Ct. ...	755-9996
		27606	
Sigma Alpha Epsilon	Robert Jordan	2701 W. Fraternity Ct. ...	834-3455
		27606	
Sigma Alpha Mu	Walter Mann	2501 W. Fraternity Ct. ...	828-8153
		27606	
Sigma Chi	Pete Currence	2409 W. Fraternity Ct. ...	833-7811
		27606	
Sigma Nu	Lee Howard	204 S. Fraternity Ct.	832-1172
		27606	
Sigma Phi Epsilon	Jeff Setser	100 S. Fraternity Ct.	832-4118
		27606	
Sigma Pi	John Ryan	Box 5656, Clark Ave.	833-5116
		27607	
Tau Kappa Epsilon	Ray Barrows	2619 W. Fraternity Ct. ...	833-6926
		27606	
Theta Chi	Bill Johnson	20 Maiden Ln., 27607	834-3585
Theta Tau	Bill Graves	PO Box 5325	847-6169
		College Station, 27650	
Zeta Beta Tau	Jered Mond	601-B Charleston Rd.	851-5372
		27606	
Freight Office	Ray Lawhorn	Central Stores	2211
Friends of the College		Univ. Stu. Ctr.	2835, 2452
Furniture Mfg. & Mgmt. In Charge	Anco L. Prak	341 Riddick	3335, 3338

G

Gas Chromatograph/Mass Spectrometer Facility Lab Supv.	Gary L. Campbell	1141 Burlington	3746
Genetics			
Head	John G. Scandalios	3513 Gardner	2292
Nursery		Reedy Creek Rd.	2757
Graduate School			2871, 2872
Vice Provost and Dean	Jasper D. Memory	103 Peele	2394
Assoc. Dean	R. E. Fornes	203 Peele	2873
Assoc. Dean	D. W. Stewart	203 Peele	2873
Assoc. Dean	A. M. Witherspoon	115 Peele	2873
Grad. Stu. Assoc.	Amy L. Suggars	3505 Gardner	3005
Graphic Communications, Occup. Educ. Coord.	Garland Hilliard	510-N Poe	2234
Grounds Superintendent	Frank Bynum	Morris Bldg.	3401

Office	Head	Address	Phone
H			
Health Occupations, Occup. Educ.			
Coord.	Judith A. Davis	510-C Poe	2234
Health Services (Student)			
Information		Clark Inf.	2563, 2564
Director	Carolyn S. Jessup	200 Clark Inf.	2562
Coord., Health Educ. Progs.	Jerry Barker	200 Clark Inf.	2563
Highway Research Program			
Coordinator	W. Grigg Mullen	309 Mann	2353
History			
Head	Burton F. Beers	157 Harrelson	3383
Home Economics Extension	Martha R. Johnson	107 Ricks	2781
Clothing	Harriet R. Tutterow	F-1 Ricks Annex	2770
Family Resource Management	Thelma Hinson	F-2 Ricks Annex	2770
Foods and Nutrition	Nadine F. Tope	F-4 Ricks Annex	2770
Housing & House Furnishings	Glenda Herman	210 Ricks	2770
Human Development	Leo F. Hawkins	F-3 Ricks Annex	2770
Horticultural Science			
Head	A. A. De Hertogh	120 Kilgore	3131
Ext. Horticulture	G. R. Hughes	160 Kilgore	3321
Housing			
Director	William W. Guy	204 Harris	3047
Asst. Dir., Facilities	Kenneth Boham	206 Harris	2410
Asst. Dir., Operations	Treka Spraggins	205 Harris	2419
Student Housing Administrator ..	Norma McDonald	201 Harris	2440
Accounting Technician	Jackie Burrell	207 Harris	3837
Off-Campus Housing		201-A Harris	3821
Resid. Hall Assignments		201 Harris	2440, 2449
Resid. Hall Repairs"		206 Harris	2410
Resid. Hall Keys		205 Harris	2419
Summer Conference Housing		205 Harris	2419
Humanities and Social Sciences, School of			
Dean	Robert O. Tilman	106 Link Bldg.	2467
Assoc. Dean	William B. Toole III	106 Link Bldg.	2468
Asst. Dean	David Garson	M-6 Link Bldg.	2467
Asst. Dean	Joan H. Stewart	M-7 Link Bldg.	2467
Social Sci. Res. & Inst. Comp.			
Lab. Dir.	G. David Garson	221 Winston	2467
Dir., Coop. Educ.	William D. Weston	106 Link Bldg.	2467
Coord., After Hours	Lynda H. Hambourger	286 Tompkins	3638
Dir., Hum. Ext.	Elliott Engel & Joseph Mastro	M-4 Link Bldg.	3451
Dir., Media Services	Ron Kemp	G-116 Tompkins	3334
Dir., N.C. Japan Center	John Sylvester Jr.	M-6 Link Bldg.	3450
Dir., Social Sci. Res. & Instructional			
Comp. Lab.	G. David Garson	221 Winston	2467
I			
Industrial and Technical Educ. Prog., Occup. Educ.			
Acting Coordinator	J. R. Clary	502-L Poe	2234
Industrial Arts Educ. Prog.			
Coordinator	Talmage B. Young	300 Poe	2234
Industrial Engineering			
Head	Thom J. Hodgson	328 Riddick	2362
Grad. Administrator	Richard H. Bernhard	342-A Riddick	2362
Coord., Advising	Raul E. Alvarez	338 Riddick	2362
Productivity Res. & Ext. Prog. ..	William A. Smith Jr.	325 Riddick	2362, 733-2370
Industrial Extension Service			
Asst. Dean for Extension	John R. Hart	260 Page	3262
Ext. Education	Daniel E. Harrell	215 Page	2356
Field Services	Thomas W. Stephenson	248 Page	2358

Office	Head	Address	Phone
Infirmary (See Health Services)			
Information Center (Student Addresses)		Univ. Stu. Ctr.	3138
Information Services			
Director	Lucy Coulbourn	Watauga	3470
Information Systems Group (See Education, Sch. of)			
Information, Visitor Parking	Doris Blalock	Info. Ctr.	3205
Institute of Statistics			
Director	D. L. Solomon	110 Cox	2420
Institutional Research			
Director			
Stu. Aff. Evaluation Dir.	Brenda H. Rogers	202 Peele	2776, 3125
International Programs	J. Lawrence Apple	209 Daniels	3201
International Student Adviser	Donald R. Roberts	1201 Univ. Stu. Ctr.	2961
International Trade Center	Charles A. Shields	213 McKimmon	3793

J

Japan Center, N.C.			
Director	John Sylvester Jr.	5 Rosemary St.	3450
<i>Journal</i> , NCSU	Marie H. Schnell	Watauga	3470

K

King Village (See Student Family Housing)

L

Landscape Architecture Program			
Director	Arthur L. Sullivan	223 Brooks	2204, 2205, 2206
Laundry and Dry Cleaning			
Manager	Lawrence W. Gower	Laundry	2122
Library, D. H. Hill			
Dir. of Libraries	I. T. Littleton	1208 Library	2843, 2595
Asst. Dir. for General Serv.	Donald S. Keener	1318 Library	2843, 2595
Asst. Dir. for Reference Serv.	William C. Lowe	1128 Library	2935
Asst. Dir. for Collections	Cyrus B. King	1137 Library	2841
Acquisitions	Nellie L. Waltner	1126 Library	3187
Binding	Phyllis Garris	G-116 Library	2842
Circulation Desk	Bonnie Baker	1212 Library	3364
General Services	Linda P. Fuller	1209 Library	3364
Interlibrary Center	Ann S. Smith	1133 Library	2116
Library Systems	William C. Horner	2110 Library	3155
Media Center Office	Pam Fleming	2305 Library	2977
Monographic Cataloging	Walter M. High	1121 Library	2603
Periodicals Serv. Center	Ann Griffith	G-114 Library	3136
Photocopy	Cynthia Hall	1222 Library	2343
Reference-Information	W. Robert Pollard	1131 Library	2935
Reserve Room	Frieda Stamper	1330 Library	2597
Serials	Gloria W. Houser	G-112-114 Library	2842
Technical Info. Ctr.	M. Ronald Simpson	1129 Library	2830
U. S. Documents	Jean Porter	2108 Library	3280

M

Marine, Earth and Atmospheric Sciences			
Head	L. Jay Langfelder	216 Withers	3717
Grad. Admin.	G. S. Janowitz	228-G Withers	3711
Undergrad. Admin.	C. D. Harrington	204 Withers	2210

Office	Head	Address	Phone
Atmospheric Sciences		214 Withers	2210
Earth Sciences		214 Withers	2210
Marine Sciences		214 Withers	3711
Marriage Counseling			
Counselors	Cranor F. Graves, Molly H. Glander	200 Harris	2423
Married Student Housing (See Student Family Housing)			
Materials Engineering			
Head	Hans Conrad	229 Riddick	3568
Assoc. Head	R. F. Stoops	229 Riddick	2377
Grad. Administrator	R. O. Scattergood	232 Riddick	2377
Mathematics			
Head	E. E. Burniston	360-A Harrelson	3798
Assoc. Head	J. B. Wilson	252 Harrelson	2382, 2383
Dir., Undergrad. Prog.	M. J. Evans	202 Harrelson	2382, 2383
Dir., Grad. Prog.	R. E. Chandler	203 Harrelson	2382, 2383
Assoc. Dir., Grad. Prog.	G. D. Faulkner	225 Harrelson	3261
Audio-Visual Tutorial Center		244 Harrelson	3157
Director	R. G. Savage	235 Harrelson	3157
Scheduling Officer	J. A. Marlin	223 Harrelson	3200
Mathematics and Science Education			
Head	Ann C. Howe	326-S Poe	2239
McKimmon Center			
Director	David B. Stansel	225 McKimmon	2277
Reservationist	Kay F. McSwain	225 McKimmon	2277
Room Set-ups	Jane E. Hodge	139 McKimmon	2277
Mechanical and Aerospace Engineering			
Head	R. A. Burton	3211 Broughton	2365, 2366
Assoc. Head, Grad. Affrs.		3211 Broughton	2684
Asst. Head, Undergrad Affrs.	B. H. Garcia	3221 Broughton	2365
Dir., Ctr. for Sound and Vib.	T. H. Hodgson	2229 Broughton	2373
Merit Awards Program			
Coordinator	Patricia J. Lee	205 Peele	3671
Microbiology			
Head	J. B. Evans	4515-B Gardner	2391
Biological Nitrogen Fixation Prog.	G. H. Elkan	Method Rd.	3281
Electron Microscopy Center	J. M. Mackenzie Jr.	1233 Gardner	2664
Middle School Education Program	John Arnold	402 Poe	3221
Military Property Custodian	Rebecca Griffith	145 Reynolds Coliseum	2427
Motor Pool	Gayle Franks	Motor Pool Bldg.	2179
Music			
Director	J. Perry Watson	203 Price Music Ctr.	2981
Mycotoxin Lab.	W. M. Hagler Jr.	Univ. Res. Farm #6, Varsity Dr.	2729, 3228

N

News Services (See Information Services)			
North Campus Bookshop	Jean P. Emerson	Erdahl-Cloyd Annex	3831
North Carolina Japan Center	John Sylvester Jr.	5 Rosemary St.	3450
North Carolina Vocational Assn.	Bill Maness	510-D Poe	2494
Nuclear Engineering			
Head	Paul J. Turinsky	1110-B Burlington	2301, 2302
Nuclear Reactor Program			
Director		2116 Burlington	2322, 2530
Nutrition Program			
Coordinator	H. A. Ramsey	232-C Polk	2766

O

Occupational Education			
Head	Joseph R. Clary	502-L Poe	2234
Agri'l. Educ. Coord.	L. R. Jewell	602-M Poe	2234

Office	Head	Address	Phone
Graphic Comm. Coord.	Garland K. Hilliard	510-N Poe	2234
Health Occupations Educ. Coord.	Judith A. Davis	510-C Poe	2234
Indus. Arts Educ. Coord.	Talmage B. Young	300 Poe	2234
Indus. & Tech. Educ. Acting Coord.	Joseph R. Clary	502-L Poe	2234
Off-Campus Housing		201-A Harris	3821
Operations Research			
Chairman	Salah E. Elmaghraby	322-A Riddick	2350

P

Payroll and Benefits	Ruth Ellis	Leazar, Lower Level	2151
Peace Corps Recruiter	Bill Anderson	3 Patterson	3818
Personnel Services			
Director	William R. Calloway	Primrose	2973
Employee Relations Mgr.	E. Ann Peters	8 Riddick Stadium	3703
Asst. Dir., Employment Services	John C. Brooks	Primrose	2135
Asst. Dir., Employee Relations/			
Development	Robert P. Allen	Primrose	2135
Asst. Dir., Position & Records Mgmt.	John W. Sellars	Primrose	2135
Position Mgmt. Analyst		Primrose	2135
Position Mgmt. Analyst		Primrose	2135
Position Mgmt. Analyst	Phyllis J. Wright	Primrose	2135
Staff Training Spec.	Cornelia B. Moore	8 Riddick Stadium	3703
Univ. Temp. Serv. Coord.		Primrose	2135
Records Mgmt. Supervisor	Kathy Tarbet	Primrose	2135
Pest Management Curriculum (IPM)			
Coordinator	Blanche C. Haning	2705 Bostian	3341
Pesticide Residue Research Laboratory			
Director	T. J. Sheets	3709 Hillsborough St.	3391
Philosophy and Religion			
Head	Robert S. Bryan	100 Winston	2477
Photographic Services		Ricks Annex	2861
Physical and Mathematical Sciences, School of			
Dean	Garrett Briggs	122 Cox	2501, 2502
Assoc. Dean, Academic Affairs ..	Robert D. Bereman	121 Cox	2502, 2503
Assoc. Dean, Research	Leslie B. Sims	113 Cox	2502, 2503
Physical Education			
Dept. Office		200 Carmichael	2486, 2487, 2488
Head	Richard A. Lauffer	201 Carmichael	3361
Intramural-Recreational Sports ..	Samuel C. Halstead	210 Carmichael	3161, 3162
Locker Room			3508
Physical Plant			
Director	Charles C. Braswell	101 Morris	2181
Dir., Depart. Serv.	Michael D. McGough	119 Morris	2181
Dir., Engineering	Carl D. Fulp	9-A Morris	2181
Dir., Gen. Serv.	Gary Y. Coates	103 Morris	2181
Dir., Oper.	David J. Goidics	109 Morris	2181
Dir., Veterinary Serv.	Winston T. Hooker	4700 Hillsborough St.	829-4217
Asst. to Dir.	Page Billingsley	101 Morris	2181
Admn. Serv. Supt.	George F. Lynch	200-B Morris	2180
Auto. Serv. Supt.	F. Randy Bowen	Motor Pool Bldg.	2179
Boiler House (nights, weekends,			
holidays—emergencies—Vet School)			829-4216
Budget and Personnel	Edward B. Phillips	209 Morris	2180
Bldg. Services Supt.	Berry Dunston	4 Park Shops	3323
Buildings Supt.	Glenn O. Ervin	14 Morris	2184
Design Serv. Supt.	Lyn E. Adams	7-A Morris	2184
Elect. Syst. Supt.	H. Carlton Seaver	16 Morris	2184
Landscape Serv. Supt.	Frank B. Bynum Jr.	Land. Serv. Bldg.	3401, 3408
Mech. Syst. Supt.	Lewis M. Strong	17 Morris	2184
Motor Pool	Gayle Franks	Motor Pool Bldg.	2179
Steam Utility Supt.	C. Tommy Barefoot	13 Morris	2184
Trade Serv. Supt.	W. D. Brazeal	3 Park Shops	3323

Office	Head	Address	Phone
Work Center		128 Morris	2991
Work Center Scheduling Officer . Jennifer F. Burdick		128 Morris	3448
Physics			
Head	R. R. Patty	106 Cox	2521, 2522
Graduate Administrator	G. E. Mitchell	105 Cox	2521, 2522
Physiology Program			
Coordinator	J. P. Thaxton	9-B Scott	2628
Phytotron (S. E. Plant Env. Lab)			
Director	R. J. Downs	2003 Gardner	2778
Placement (See Career Planning and Placement)			
Plant Pathology			
Head	Robert Aycock	2518 Gardner	2730
Ext. Plant Pathology	H. E. Duncan	1410 Gardner	2711, 2712
Plant Disease & Insect Clinic		1300 Gardner	3619
Graduate Student Offices		3419 Gardner	2753
Int'l. Meloidogyne Contract Lab.		1415 Gardner	3488
Biological Sciences Greenhouse			3137
840 Method Road	K. R. Barker	Unit #2	3330
840 Method Road	D. M. Benson	Unit #3	3966
840 Method Road	R. A. Reinert	Unit #3	3962
Plant Sci. Res., USDA	D. P. Schmitt	3127 Ligon St.	3905
Tobacco Headhouse			3306
Police—Campus	Communications Ctr.	Field House	3333
Political Science and Public Administration			
Head	J. Oliver Williams	215 Link	2481, 2482
Asst. Head	John H. Gilbert	217 Link	2481, 2482
Dir., MPA Div.	Erika S. Fairchild	220 Link	2481, 2482
Dir., Criminal Justice Option	Eva R. Rubin	223 Link	2481, 2482
Dir., Law & Political Philosophy			
Concentration	Sanford H. Kessler	208 Link	2481, 2482
Dir., Undergrad. Advising	Keith S. Petersen	202 Link	2481, 2482
Poultry Science			
Head	R. E. Cook	120 Scott	2626
Ext. Poultry Science	T. A. Carter	208 Scott	2621
Premedical Program			
Chairman		1628 Gardner	2402
Product Design Program			
Director	Vincent M. Foote	220 Brooks	2204, 2205, 2206
Productivity Research and Extension Program (PREP)			
Dir.	William A. Smith Jr.	324 Riddick	733-2370
Program Office		3114 Univ. Stu. Ctr.	2451, 2453
Provost and Vice Chancellor's Office			
Provost and Vice			
Chancellor	Nash N. Winstead	109 Holladay	2195
Assoc. Provost	Murray S. Downs	103 Holladay	2194
Assoc. Provost and Affirmative Action			
Officer/Compliance Officer			
for Title IX	Lawrence M. Clark	201 Holladay	3148
Asst. Provost for Univ.			
Computing	LeRoy B. Martin Jr.	M2A Hillsborough Bldg.	2516
Psychology			
Head	Paul W. Thayer	640-D Poe	2251
Public Administration Program	Erika S. Fairchild	220 Link	2060
Public Safety			
Emergency			3333
Director	Chief James W. Cunningham	101 Field House	2157
Deputy Dir., Operations	Capt. Larry D. Liles	103 Field House	3206
Deputy Dir., Admin.	Capt. James M. Eubanks	103 Field House	2156
Deputy Dir., Life Safety Services		105-A Field House	2568
Patrol Oper. Coord.	Lt. Wilbur G. Price	103 Field House	3206
Support Services Coord.	Lt. Terry Abney	103 Field House	2156
Administrative Sergeant		103 Field House	2156
Crime Prevention	Ptl. Judy W. Black	103 Field House	2156
Investigations	Det./Sgt. Laura K. Reynolds	103 Field House	2498
Parking Control Mgr.	Sam L. Penny	103 Field House	2156
Hazardous Waste Spec.	Robert V. Ginnis	105-A Field House	2568

Office	Head	Address	Phone
OSH Consultant	Henderson B. Gabriel	105-A Field House	2568
Shift Commanders	Sgt. William F. Bowden	103 Field House	3206
	Sgt. Joellen M. Nader	103 Field House	3206
	Sgt. Lyndwood R. Stevens	103 Field House	3206
	Sgt. John G. Wieland	103 Field House	3206
	Sgt. C. Renee Wood	103 Field House	3206
Publications, Agri'l. Ext. and Agri'l. Res. Serv.	W. L. Carpenter	318 Ricks	3173
Publications, Student	Betty Curtin	3134 Univ. Stu. Ctr.	2413
	Rodney Woodlief	3134 Univ. Stu. Ctr.	2413
Pulp and Paper Science	R. G. Hitchings	2106 Robertson	2888
Purchases and Stores			
Director	Anne W. Watts	214 Alumni	2171
Admn. Sec./Surplus Admin.	Linda Allred	212 Alumni	2171
Interior Designer	Briget Pollock	216 Alumni	2171
Purchasing Officer	Bob Knoll	201 Alumni	2171
Purchasing Officer	Matthew Mills	206 Alumni	2171
Purchasing Officer	Felton Tilley	200 Alumni	2171
Purchasing Officer	Miriam Tripp	204 Alumni	2171
Purchasing Agent	Mary Sanders	210 Alumni	2171
Purchasing Agent	Annette Wahab	216 Alumni	2171
Purchasing Agent	Richard Williams	200-A Alumni	2171
Status Clerks	Gayle Peacock/Raye Taylor	217 Alumni	2171
Systems Clerk	Judy Shepherd	220 Alumni	2171

R

Radiation Protection Office			
Radiation Protection Officer	L. T. Caruthers	214 Clark Lab.	2894
Assoc. Radiation Protection Officer	D. W. Morgan	214 Clark Lab	2894
Chairman, Radiation Protection Council	D. E. Smith	1607 Gardner	2593
Radio Station			
WKNC-FM	Don Dickenson	3122 Univ. Stu. Ctr.	2400
Reading Education Program			
Coordinator	Barbara J. Fox	402 Poe	3221
Recreation Resources Administration			
Head	M. Roger Warren	4008-C Biltmore	3276
Registration and Records			
Univ. Registrar	James H. Bundy	218 Harris	2576
Asst. Registrar	Kenneth W. Hammond	100 Harris	2572
Asst. Registrar	Donna C. Redmon	100 Harris	2572
Asst. Registrar	Mary A. Tetro	217 Harris	2576
Data Processing	Jeff Hunter	115 Harris	3084
Readmissions		100 Harris	2572
Scheduling (Classrooms)	Anita Hanover	217 Harris	2577
Student Records & Transcripts		100 Harris	2572
Veterans Affairs		217 Harris	3048
Religious Affairs (See Cooperative Campus Ministry)			
Research			
Vice Provost and Dean	Henry B. Smith	208 Daniels	2117
Assoc. Dean	Howard W. Etzel	208 Daniels	2117
GC/MS Facility	Gary L. Campbell	1141 Burlington	3746
Sponsored Funds Info. Ctr.	Rennie Dupree	211 Daniels	2444
Residence Halls			
Alexander Head Resid.	Scott Hager	Alexander	2925
Bowen Head Resid.	LeeAnn Britt	Bowen	2901
Bragaw Resid. Dir.	Sotello Long	Bragaw	2903
Carroll Head Resid.	Dottie Venable	Carroll	2905
Lee Resid. Dir.	Lynette Lucas	Lee	2900
Metcalf Coord.	Cheryl DiBucci	Metcalf	2908
Middle East (Syme, Gold, Welsh)			
Head Resid.	Sharyl Mason	Syme	3605

Office	Head	Address	Phone
North Head Resid.	Scotti Holcombe	North	3651
Owen Head Resid.	Ken Dickson	Owen	2924
Quad (Berry, Becton, Bagwell)			
Head Resid.	Connie Carson	Berry	2923
South Resid. Dir.	Jeff Compher	South	
Sullivan Resid. Dir.	Melissa Graves	Sullivan	2921
Tucker Head Resid.	Joe Dowling	Tucker	2922
Turlington Head Resid.	Michael Blackwell	Turlington	2929
Residence Hall Coordinators			
East Campus	Ruel Charles	Becton	3610
Central Campus	Don Kenney	Turlington	3028
West Campus	Karen Morrow	Sullivan	3093
Metcalf Living Learning	Cheryl DiBucci	Metcalf	2908
Residence Life			
Director	Cynthia Davis-Palcic	208-A Harris	2406
Assoc. Dir.	Susan Manley Randall	208 Harris	2406
Residence Life, Special Programs for			
Director	Charles Oglesby	Alexander	2087
Assoc. Dir.	David Stuckey	Alexander	2088
Preceptor	Susan Hubbell	Berry	2353
Friends of Adam Smith			
Coord.	Jeff Moretz	Sullivan	2087
ROTC (See Air Force and Army)			

S

Scholars of the College			
Preceptor	Susan E. Hubbell	Berry	2353
Sea Grant Program, UNC			
Director	B. J. Copeland	105 1911 Bldg.	2454
Assoc. Dir.	Ronald G. Hodson	105 1911 Bldg.	2454
Dir., Marine Advisory Serv.	James D. Murray	105 1911 Bldg.	2454
Snack Bar Operations			
Director	Walter E. Barkhouse	Quad	2124
Bragaw Snack Bar	Barbara Okoh	Bragaw	3095
Erdahl-Cloyd Annex	Mary Beachler	Erdahl-Cloyd Annex	3270
McKimmon Ctr. Snack Bar	Myrtle Lewis	McKimmon Ctr.	3090
Quad Snack Bar	Marilyn Atkins	Quad	2124
Shuttle Inn	Rose Stewart	Nelson	2128
Syme Snack Bar	Sallie Lane	Syme	2127
Tunnel Inn	Madeline Carter	SSS Bldg.	2166
Social Studies Education	Charles Harper	408 Poe	3221
Sociology and Anthropology			
Head	Ronald C. Wimberley	341 1911 Bldg.	3180, 3114
Asst. Head.	M. Mohan Sawhney	234 1911 Bldg.	2491, 2492
Ext. Spec.-in-Charge	Maurice E. Voland	237 1911 Bldg.	2670
Grad. Administrator	Robert L. Moxley	315 1911 Bldg.	2702, 2610
Dir., Social Work	P. Nelson Reid	334 1911 Bldg.	3291, 3299
Soil Science			
Head	R. H. Miller	2234 Williams	2655, 2656
Academic Programs	M. G. Cook	2238 Williams	2643
Extension Programs	J. V. Baird	1225 Williams	3285
International Programs	J. J. Nicholaides	3104 Williams	2838
	P. A. Sanchez	3104 Williams	2838
Solar House			3799
Sororities			
Panhellenic Council	Shannon Newman	214 Harris	2441
Alpha Delta Pi	Carol Robins	2709-B W. Fraternity Ct.	834-1550
		27606	
Alpha Kappa Alpha	Theresa White	701-C Carroll	5834
Alpha Xi Delta	Darla Hornsby	3027-H Holston Ln.	821-0332
		27610	

Office	Head	Address	Phone
Delta Sigma Theta	Octavia Matthews	502-A Sullivan	5086
Sigma Kappa	Anna Murrelle	27606	
Southeastern Plant Environment Lab. (see Phytotron)		2709-A W. Fraternity Ct. .	833-4710
Southern Engineer		27606	
Special Education Program		227 Daniels	3124
Coordinator	Cathy L. Crossland	402 Poe	3221
Speech-Communication			
Head	William G. Franklin	206 Winston	2450, 3204, 3247
Asst. Head	Raymond R. Rodgers	214-A Winston	2450, 3204, 3247
Speech, Hearing and Language			
Clinic	Gail Schumacher	222 Winston	3767
Speech-Communication Audio	James Alchediak	2316-B Library	3303
	Edward Funkhouser	2316 Library	3303
	Robert Schrag	207 Winston	2450, 3204
Sports Information (Varsity)			
Dir.	Ed Seaman	Case Athl. Ctr.	2102
State Employees' Credit Union (See Credit Union)			
Statistics			
Dept. Office		103-B Cox	2528
Head	D. L. Solomon	110 Cox	2420
Grad. Administrator	T. M. Gerig	111 Cox	2528
Undergrad. Administrator	J. L. Wasik	614-F Cox	2532
Biomathematics Graduate Prog. Dir.	H. J. Gold	513-F Cox	2271
Student Accounts (Tuition & Fees)			
Director	W. R. Styons	2 Peele	2986
Cashiers	Jerry LaGarde	2 Peele	2988
	Kay Matthews	2 Peele	2988
Loan Section	James Sweet	2 Peele	2985
Student Address Information (See University Student Center)			
Student Affairs			
Vice Chancellor	Banks C. Talley Jr.	(On Leave)	
Interim Vice Chancellor	Thomas H. Stafford Jr.	101 Holladay	2446
Asst. to Vice Chan. for Stu. Affairs			
Univ. Dining	Arthur L. White	3102 Univ. Stu. Ctr.	3090
Assoc. Vice Chan.	Henry Bowers	Univ. Stu. Ctr.	2452
Assoc. Vice Chan.	Ronald C. Butler	205 Peele	2962
Assoc. Vice Chan.	Gerald G. Hawkins	210 Harris	3151
Assoc. Vice Chan.	Charles A. Haywood	209 Harris	3499
Special Asst., Grants	Edwina W. Thompson	202 Peele	3125, 2776
Student Affairs Data Processing	Jeff Hunter	115 Harris	3084
Student Center (See University Student Center)			
Student Development			
Director	Larry W. Gracie	212 Harris	2441
Assoc. Dir.	Evelyn Reiman	220 Harris	2441
Asst. Dir.	Robert S. Bryan Jr.	214 Harris	2441
Asst. Dir., Legal Services	Elwood Becton	216 Harris	2963
Asst. Coor., Frat. & Sororities	Michael Borden	214 Harris	2441
Student Employment (part-time			
work) Counselor	Mary Usry	216 Peele	2421
Student Family Housing			
Coord.	Joyce Clark	E.S. King Vlg.	2430
Student Government			
President	Jim Yocum	4130 Univ. Stu. Ctr.	2797
Senate Pres.	Richard Holloway	4130 Univ. Stu. Ctr.	2797
Treasurer	Marold H. Kamai	4130 Univ. Stu. Ctr.	2797
Attorney General	Wade Ritter	4130 Univ. Stu. Ctr.	2797
Student Publications (See Publications)			
Student Records and Transcripts		100 Harris	2572
Students Supply Stores			
Gen. Mgr.	G. Robert Armstrong	SSS Bldg.	3117, 2161
Asst. Gen. Mgr.	Douglas Small Jr.	SSS Bldg.	3117, 2161
Book Depts. Dir.	T. V. Setzer	SSS Bldg.	2161
Mdse. Dir.	Willard Carpenter	SSS Bldg.	2161
Personnel Dir.	Aline Roberson	SSS Bldg.	2161
North Campus Bookshop	Jean P. Emerson	Erdahl-Cloyd Annex	3831

Office	Head	Address	Phone
Summer Institute in English for Speakers of Other Languages			
Director	Virginia M. Prichard	134 Harrelson	3297
Summer Sessions			
Director	John F. Cudd	145-C McKimmon	2265
Systems Accounting and Data Processing			
Director	W. Jerry Pounds	14 Peele	2459

T

Technical Information			
Center	M. Ronald Simpson	1129 Library	2839, 2830
Technician			
Editor	Jeff Bender	3120 Univ. Stu. Ctr.	2411
Telephone Services			
Supervisor	Olive A. Stone	112 Winston	2141
Operator	Rosemarie Relyea	112 Winston	"O"
Television (UNC Center for Public Television)			
Production Coord.	Richard Snavely	211-A Television Ctr.	2853
Textile Chemistry			
Head	Wilson M. Whaley	115 Clark Lab.	2551
Asst. Head & Academic Coord.	C. D. Livengood	115 Clark Lab	2551
Graduate Administrator	D. M. Cates	3 Clark Lab	2551
Textile Mat. and Mgmt.			
Acting Head	S. P. Hersh	102 Nelson	3253
Academic Coord.	E. E. Hutchison	122 Nelson	3485
Graduate Administrator	B. S. Gupta	B-2A Nelson	3481
Textiles Extension			
Assoc. Dean & Dir.	P. L. Grady	107 Nelson	3057
Textiles, School of			
Dean	Dame S. Hamby	101 Nelson	3231
Assoc. Dean, Academic Programs	M. H. Mohamed	126 Nelson	3485
Asst. Dean, Textile Research & Graduate Studies	W. K. Walsh	107-B Nelson	3057
Asst. to the Dean for Student Serv. & Placement Dir.	W. E. Smith	120 Nelson	3780
Library	Georgia Rodeffer	112 Nelson	3043
Theatres			
Center Stage		Univ. Stu. Ctr.	3900
Stewart	Susan L. Coon	Univ. Stu. Ctr.	3104
Thompson	Charles A. Martin Jr.	Thompson Bldg.	3147, 2405
Tobacco Literature Service	Carmen Marin	2314 Library	2836, 2837
Toxicology Program			
Chairman	Ernest Hodgson	1519 Gardner	2274
Transcripts and Student Records		100 Harris	2572
Transportation			
Director	Janis Y. Ross	5 Field House	3424
Asst. Dir.	Anne W. Hitchcock	5 Field House	3424
Parking Serv. Mgr.	Rachel Dupree	100 Coliseum	3269, 2120
Visitor Info. Hostess	Doris Blalock	Info. Booth	3205
Travel Audit			
Supv.	Brenda G. Burnett	1 Holladay	3497
Triangle Universities			
Computation Center	Leland H. Williams	Box 12076, Res. Tri. Park	549-0671
TV, Closed Circuit Prog.	Lee Downs	2324 Library	3895

Office	Head	Address	Phone
U			
University Cashier	Jerry LeGarde	2 Peele	2988
	Kay Matthews	2 Peele	2988
University Dining			
Asst. to Vice Chan. for Stu.			
Aff. for Univ. Dining	Arthur L. White	3102 Univ. Stu. Ctr.	3090
Dir., Operations	Walter E. Barkhouse	Quad	2124
Business Manager	Verna Wentz	B116 Univ. Stu. Ctr.	3090
Asst. Dir., Univ. Stu. Ctr.	David Rittenhouse	Univ. Stu. Ctr.	3090
Dir., Contract Dining Ser.	Nida N. Vance	Dining Hall	3963
Dir., Food Serv. Prod.	Zeph Putnam	Dining Hall	3963
Dir., Reservations & Catering	Lucie R. Hunter	2102 Univ. Stu. Ctr.	3090
University Graphics			
Manager	John W. Lee	Univ. Graphics	2131
Production Mgr.	Thomas F. Joyner Jr.	Univ. Graphics	2131
Copy Center Mgr.	Melody S. West	108 Parks Shops	3460
University Research Units			
Supt.-In-Charge	H. V. Marshall Jr.	108 Patterson	2823
Unit 1	J. S. Starr	4616 Reedy Crk. Rd.	2713
Unit 2	J. R. Williams	3720 Lake Wheeler Rd.	2759
Weather Data			833-9949
Unit 4	John Scott	4301 Beryl Rd.	3144
University Self-Study For Reaccreditation			
Chairman	Grover J. Andrews	202 McKimmon	3373
Exec. Sec.	J. A. Rigney	208 McKimmon	3943
Asst. Exec. Sec.	Malcolm R. Spaulding	208 McKimmon	3943
University Student Center			
Director	Henry Bowers	Univ. Stu. Ctr.	2452
Assoc. Dir.	Lee R. McDonald	Univ. Stu. Ctr.	2558
Asst. Dir., Univ. Dining	David Rittenhouse	Univ. Stu. Ctr.	3090
Craft Shop Dir.	Conrad W. Weiser	Thompson Bldg.	2457
Curator of Art	Charlotte V. Brown	Univ. Stu. Ctr.	3503
Program Office		3114 Univ. Stu. Ctr.	2451, 2453
Reservations	Lucie R. Hunter	Univ. Stu. Ctr.	2249
Student Address & Info.	Information Center	Univ. Stu. Ctr.	3138
Student Center President	Stan Gallagher	Univ. Stu. Ctr.	2453
University Studies, Division of			
Head	John M. Riddle	144 Harrelson	2479, 2470
University Systems Analysis and Control Center			
Director	Siamak Khorram	338 Daniels	3430
University Temporary Services		Primrose	2135, 2137
Upward Bound Dir.	Cynthia J. Harris	205 Peele	3632
Counselor	William T. Holloman	205 Peele	3632
Urban Affairs and Community Services, Center for			
Assoc. Director	David A. Norris	289 McKimmon	3211
USDA-Agricultural Research Service			
Area Director	George R. Burns	1 Patterson	2844
Assoc. Area Dir.	Dean W. Winter	1 Patterson	2844
Area Admn. Officer	Edward J. Foley	51 Kilgore	2731
USDA-ARS-Boll Weevil Eradication Research			
Entomologist in Charge	W. A. Dickerson	4116 Reedy Cr. Rd.	3560
		27607	

V

Veterans Affairs	217 Harris	3048
Veterinary Anatomy, Physiological Sciences & Radiology		
Head	A. L. Aronson	4700 Hillsborough St.
Veterinary Companion Animal & Special Species Medicine		
Head	S. W. Crane	4700 Hillsborough St.

Office	Head	Address	Phone
Veterinary Food Animal & Equine Medicine			
Head	W. D. Oxender	4700 Hillsborough St.	829-4240
Veterinary Library			
Librarian	T. J. Fischer	4700 Hillsborough St.	829-4219
Veterinary Medicine, School of			
Operator/Information			829-4200
Dean	T. M. Curtin	4700 Hillsborough St.	829-4210
Business Officer	J. W. Green	4700 Hillsborough St.	829-4214
Academic Affairs			
Assoc. Dean & Dir.	D. R. Howard	4700 Hillsborough St.	829-4212
Admissions Dir.	M. C. Motley	4700 Hillsborough St.	829-4205
Biomedical Communications Dir.	P. J. Difatta	4700 Hillsborough St.	829-4206
Research & Graduate Studies			
Assoc. Dean & Dir.	C. E. Stevens	4700 Hillsborough St.	829-4213
Veterinary Medical Services			
Assoc. Dean & Dir.	W. M. Adams	4700 Hillsborough St.	829-4211
Veterinary Animal Resources			
Dir.	C. W. McPherson	4700 Hillsborough St.	829-4280
Veterinary Clinical Practice			
Field Services	M. D. Whitacre	4700 Hillsborough St.	829-4260
Avian Field Services	H. J. Barnes	4700 Hillsborough St.	829-4273
Veterinary Equine Research Ctr.	June Nobles	Southern Pines	692-8773
Veterinary Extension			
Bovine & Swine	R. F. Behlow	204 Polk	2566
Poultry	J. R. Harris	214 Scott	2621
Veterinary Microbiology, Pathology & Parasitology			
Head	Leroy Coggins	4700 Hillsborough St.	829-4250
Veterinary Services			
To report malfunctions & breakdowns			
Veterinary Serv. Sec.			
(during working hours)		4700 Hillsborough St.	829-4217
Boiler House (nights, weekends or holidays)			829-4216
Visual Communications		G-1 Ricks	2861
Volunteer Services	Susan Harrington	1201-A Univ. Stu. Ctr.	3193

W

Water Resources Research Institute			
Director	David H. Moreau	124 Riddick	2815
Assoc. Dir.	James M. Stewart	124 Riddick	2815
Admn. Off.	Linda Kiger	124 Riddick	2815
Windhover Editor	James Nunn	3132 Univ. Stu. Ctr.	3614
WKNC-FM Radio Station			
Manager	Don Dickenson	3122 Univ. Stu. Ctr.	2401
Wolfpack Club			
Director	Charlie Bryant	College Inn	2112
Wood and Paper Science			
Head	Richard J. Thomas	1022-N Biltmore	3181
Wood Products Lab	Robert C. Gilmore	Hodges Lab.	2881

Z

Zoology			
Head	John G. Vandenberg	2123 Gardner	2741
Graduate and Undergraduate			
Coord.	Grover C. Miller	1627 Gardner	2588
Fisheries and Wildlife Coord.	William M. Lewis	2115 Gardner	2741
Small Animal Facility	Leamon Lassiter	Ligon St.	3218

OFF-CAMPUS STATIONS

Border Belt Tobacco Research Station (NCDA)	648-4703
Supt.—Wallace J. Dickens, Rt. 1, Whiteville 28472	
Central Crops Research Station (NCSCU)	553-6468
Supt.—W. R. Baker Jr., Box 303, Clayton 27520	
Weather Data	553-4810
Hatteras Marine Research Station	
Dir.—W. W. Hassler, Box 615, Hatteras 27943	
Horticultural Crops Research Station (NCSCU)	675-2314
Supt. T.L. Blake, Rt. 2, Box 610, Castle Hayne 28429	
Weather Data	675-9949
Horticultural Crops Research Station (NCDA)	592-7839
Supt.—Fred E. Cumbo, Rt. 5, Box 43, Clinton 28328	
Lower Coastal Plain Tobacco Research Station (NCSCU)	527-3579
Supt.—S. T. Barnes, Rt. 1, Box 442-A, Kinston 28501	
Minerals Research Laboratory, Asheville	704-258-6155
Chief Engineer—Immo H. Redeker, 180 Coxe Ave., Asheville 28801	
Mountain Horticultural Crops Research Station (NCSCU)	704-684-7197
Supt.—Harley E. Blackwell, Rt. 2, Fletcher 28732	
Weather Data	704-687-1994
Mountain Research Station (NCDA)	704-456-3943
Supt.—J. R. Edwards, 516 Test Farm Rd., Waynesville 28786	
Oxford Tobacco Research Station (NCDA)	693-2483
Supt.—W. C. Clements, Box 1114, Oxford 27565	
Peanut Belt Research Station (NCDA)	348-2213
Supt.—Raymond D. Coltrain, Box 220, Lewiston 27849	
Weather Data	348-2255
Piedmont Research Station (NCDA)	704-278-2624
Supt.—B. N. Ayscue, Rt. 6, Box 420, Salisbury 28144	
Weather Data	704-278-9383
Rural Development Engineering Project	298-2172
Coord.—Louis M. Smith, 435 Woodridge, Murfreesboro 27855	
Sandhills Research Station (NCSCU)	974-4673
Supt.—Clarence S. Black, Rt. 1, Jackson Springs 27281	
Seafood Laboratory, Dept. of Food Science (NCSCU)	726-7341
Ext. Spec.—Sam D. Thomas, P.O. Box 1137, Morehead City 28557	
Tidewater Research Station (NCDA)	793-4118
Supt.—John W. Smith, Rt. 2, Plymouth 27962	
Upper Coastal Plain Research Station (NCDA)	442-7326
Supt.—J. W. Sumner, Rt. 2, Rocky Mount 27801	
Upper Mountain Research Station (NCDA)	982-2501
Supt.—Dana F. Tugman, Laurel Springs 28644	
Upper Piedmont Research Station (NCSCU)	349-8347
Supt.—Howell O. Gentry Jr., Rt. 3, Reidsville 27320	
Veterinary Equine Research Center	692-8773
Lab. Supv.—June Nobles, P.O. Drawer 211, Southern Pines 28387	

COUNTY EXTENSION OFFICES

Alamance—201 Elm St.	
Millis B. Wright, Box 418, Graham	227-1482
Alexander—325 First Ave., S.W.	
B. G. Westbrook, Box 68, Taylorsville	704-632-4451
Alleghany—Community Bldg.	
Mrs. Helen H. Dosier, Box 7, Sparta	372-5597
Anson—605 McLaurin St.	
Hoover M. Royals, Box 268, Wadesboro	704-694-2415
Ashe—County Office Bldg.	
James C. Carey, Jr., Box 338, Jefferson	246-3021
Avery—Courthouse	
J. Michael Pitman, Box 367, Newland	704-733-2415
Beaufort—Agriculture Bldg.	
Marion C. Griffin, Box 1967, Washington	946-0111
Bertie—Agricultural Bldg.	
William J. Griffin, Box 280, Windsor	794-3194

Bladen—Agricultural Service Ctr. M. Keith Dennis, Box 248, Elizabethtown	862-4591
Brunswick—Government Center R. Milton Coleman, Box 109, Bolivia	253-4425
Buncombe—Allen Center, 331 College St. G. E. Biddix Jr., Box 7667, Asheville	704-255-5522
Burke—Human Res. Center, East Parker Rd. H. Leslie Miller, Box 949, Morganton	704-433-4050
Cabarrus—745 Cabarrus Ave. Alvin M. Stanford, Box 387, Concord	704-782-0212
Caldwell—Agricultural Center Tom E. Andrews, 611 Lower Creek Dr., Lenoir	704-758-8451
Camden—County Office Bldg. Gordon E. Sawyer, Camden	338-0171
Carteret—Courthouse Square James F. Bunce, Drawer 630, Beaufort	728-8421
Caswell—Agricultural Bldg. Larry N. Whitt, Box 220, Yanceyville	694-4158
Catawba—County Administrative Bldg. Edwin F. Nolley, Box 389, Newton	704-464-7880
Chatham—Agriculture Bldg. Carl Outz, Box 278, Pittsboro	542-3974
Cherokee—County Office Bldg. Jack E. Earley, 115 Peachtree St., Murphy	704-837-2210
Chowan—Hewes Hotel Bldg. John Michael Williams, Box 1030, Edenton	482-8431
Clay—Community Service Center J. B. Reeves, Box 156, Hayesville	704-389-6301
Cleveland—County Office Bldg. B. Frank Spencer, 130 S. Post Rd., Shelby	704-482-4365
Columbus—Courthouse Annex Garland McCullen, Box 569, Whiteville	642-2788, 642-2795
Craven—509 Broad St. E. J. Simpson, Box 1340, New Bern	633-1477
Cumberland—County Office Bldg. B. T. McNeill, Box 270, Fayetteville	484-7156
Currituck—Courthouse Jerry W. Hardesty, Box 10, Currituck	232-2261
Dare—County Admin. Robert I. Spake, Box 458, Manteo	473-2143
Davidson—County Bldg. W. C. Holtzmann, Box 1666, Lexington	704-246-5233
Davie—County Office Bldg. William E. Mainous, Box 526, Mocksville	704-634-6297
Duplin—County Office Bldg. Mrs. Lois Britt, Box 458, Kenansville	296-1996
Durham—Agriculture Bldg. Carl D. Hodges, 721 Foster St., Durham	688-2240
Edgecombe—County Admin. Bldg. James R. Pearce, Box 129, Tarboro	823-8131
Forsyth—Agriculture Bldg. John D. Carroll, 1450 Fairchild Dr., Winston-Salem	767-8213
Franklin—Agriculture Bldg. C. T. Dean Jr., 307 E. Nash St., Louisburg	496-3344, 496-3449
Gaston—Agriculture Center Mrs. Martha A. Burris, Box 476, Dallas	704-866-3002
Gates—Agricultural Bldg. Zackie W. Harrell, Box 46, Gatesville	357-1400
Graham—Main Street Raymond A. Norton, Box 486, Robbinsville	704-479-3320
Granville—County Office Bldg. Frank H. Baker, Box 926, Oxford	693-8806
Greene—229 Kingold Blvd. Herbert Ray Williams, Snow Hill	747-5831
Guilford—Agricultural Center John A. Crawford, Box 20428, Greensboro	375-5876
Halifax—Agricultural Bldg. Clyde D. Peedin, Box 37, Halifax	583-5161

Harnett—County Office Bldg. James E. Goff, Box 11357, Lillington	893-3339
Haywood—Federal Bldg. H. E. McCall, Box 308, Waynesville	704-456-3575
Henderson—Agricultural Ext. Bldg., 740 Glover St. G. W. Westmoreland, Hendersonville	704-692-0216
Hertford—County Office Bldg. James E. Wright, Box 188, Winton	358-1591, 358-1501
Hoke—Magnolia St. Box 578, Raeford	875-3461, 875-2162
Hyde—Agricultural Bldg. G. W. O'Neal, Box 219, Swan Quarter	926-3201
Iredell—Agricultural Center, 201 E. Water St. Kenneth E. Vaughn, Box 311, Statesville	704-873-0507
Jackson—Community Service Center William Gerald McAbee, 102 Scotts Creek Rd., Sylva	704-586-4009
Johnston—Agriculture Bldg. Bruce Woodard, Box 1457, Smithfield	934-5003
Jones—2 South Market St. Minton C. Small, Box 218, Trenton	448-9621
Lee—Courthouse Annex John Vann Hall, 225 S. Steele St., Sanford	775-5624
Lenoir—Federal Bldg. William S. Lamm, Box 757, Kinston	527-2191
Lincoln—Citizens Center David P. Choate, Box 68, Lincolnton	704-732-3361
McDowell—County Admin. Bldg., Room 122 James R. Mabe Jr., Marion	704-652-7030
Macon—County Courthouse & Admin. Bldg. Robert W. Rollins, 5 W. Main St., Franklin	704-524-6421
Madison—Roberts Bldg. Earle Wise, Box 609, Marshall	704-649-2411
Martin—Agriculture Bldg. Leon Allen, Box 1148, Williamston	792-1621
Mecklenburg—Rm. 100, 301 Billingsley Rd. Phil Haas, Charlotte	704-374-2561
Mitchell—Agricultural Bldg. David E. Terrell, Box 366, Bakersville	704-688-4811
Montgomery—Agricultural Bldg. Roy W. Reece Jr., Box 467, Troy	576-6011
Moore—Agricultural Bldg. Charles E. Hammond, Box 1149, Carthage	947-5800
Nash—Agricultural Ctr., Agricultural Center Dr. James D. Stephenson, Nashville	459-4141
New Hanover—Agricultural Extension Bldg. Charles E. Lewis, 222 Division Dr., Wilmington	762-1848
Northampton—Agricultural Bldg. E. W. Rogister, Box 606, Jackson	534-2711
Onslow—Rm. 8, 604 College St. Dan E. Baucom, Jacksonville	455-5873
Orange—Agriculture Bldg. Ebert L. Pierce, 109 Court St., Hillsborough	732-9361 (Ext. 440)
Pamlico—Courthouse Annex Richard F. May, Box 8, Bayboro	745-4121
Pasquotank—Agriculture Bldg. Donald W. Baker, Box 1608, Elizabeth City	338-3954
Pender—County Office Bldg. W. F. Walker, Box 834, Burgaw	259-2330
Perquimans—Agricultural Bldg. W. R. Jester III, Box 87, Hertford	426-5428
Person—County Office Bldg. Frederick J. Rivers, Box 1115, Roxboro	599-1195
Pitt—County Office Bldg. Leroy James, 1717 W. 5th St., Greenville	758-1196
Polk—Extension-Education Bldg. O. Reagan Ammons, Box 187, Columbus	704-894-8218
Randolph—2222 S. Fayetteville St. T. S. Baker, Box 818, Asheboro	629-2131

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Faculty:

Richard J. Leuba, *Chairman*
Shoshana Serxner, *Treasurer*
Richard C. Axtell
George A. Cummings
Joseph S. Kahn
Ralph McGregor
James A. Seagraves
John S. Strenkowski

Ex officio:

Lauren Brisky

LABORATORY ANIMAL CARE AND FACILITIES

Faculty:

	Term Expires
Charles W. McPherson, <i>Chairman</i>	1986
George L. Catignani	1986
George J. Kriz	1985
Thomas E. LeVere	1986
William L. Miller	1984
Harold A. Ramsey	1984
Herbert A. Underwood	1986
Margaret S. Young	1986

Ex officio:

Dean for Research (Henry B. Smith)

LIBRARY

Faculty:

Edwin R. Gerler, *Chairman*
Larry F. Grand
Edward D. Gurley, *Senate*
Joseph Hale
P. Nelson Reid
Michael Theil
Judith F. Thomas
Susan J. Updike
H. R. van der Vaart
Eleanor F. Weinel

Ex officio:

Dir. of Libraries (I. T. Littleton)
5 Student Members

MEDIA ADVISORY

Faculty:

Bruce G. Beezer, *Chairman*
James Alchediak
Richard C. Allison, *Senate*
Jack V. Baird
Peter J. Difatta
Daniel Harrell
P. Lyn Middleton
Thomas L. Russell
Robert G. Savage
Beth E. Wilson

Ex officio:

Larry Clark
Ronald Butler
Grover J. Andrews
2 Student Members

PATENTS

Faculty or Staff:

Clauson L. Jenkins, *Chairman*
Lauren J. Brisky
Irving S. Goldstein
William H. Johnson
John S. Risley
William K. Walsh

Ex officio:

Henry B. Smith

PLANNING AND ENVIRONMENT

Faculty or Staff:

Ronald Sneed, *Chairman*
Lauren J. Brisky
E. W. Davis Jr.
J. Wendell Gilliam
Will E. Hooker
David W. Johnson
Linda Sanders, *Senate*
Jack L. Shannon
William R. Styons

Ex officio:

Rep., Provost's Off. (William H. Simpson)
Dir., Campus Plan. & Const. (Edwin F. Harris Jr.)
Dir., Phys. Plant (Charles C. Braswell)
Dir., Trans. (Janis Y. Ross)
6 Student Members

RADIATION PROTECTION COUNCIL

Faculty:

	Term Expires
Donald E. Smith, <i>Chairman</i>	1986
Lawrence M. Ballas	1985
Betty L. Black	1986
Jim D. Garlich	1985
Richard D. Gilbert	1986
J. Richard Mowat	1985
James A. Mulholland	1985
John F. Roberts	1985
Raymond Saxe	1986
James E. Smallwood, <i>Senate</i>	1984
Ephraim Stam	1984

Ex officio:

Rad. Prot. Officer, (L. Thomas Caruthers)
Liaison, Phys. Plant, (Lyn E. Adams)
Nuc. Reactor Prog. (Thomas C. Bray)
Assoc. Dir., OSHA, (Donald Gray)

REACTOR SAFEGUARDS ADVISORY GROUP

Faculty:

	Term Expires
Jimmie J. Wortman, <i>Chairman</i>	1984
K. L. Murty	1986
Arthur W. Waltner	1985

Ex officio:

Assoc. Rad. Prot. Officer (D. William Morgan)

REGISTRATION, RECORDS AND CALENDAR

Faculty:

Victor A. Jones, *Chairman*
Robert C. Brisson
Joel V. Brothers
Charles F. Lytle
Hubert L. Owen
Sarah A. Rajala, *Senate*

Ex officio:

Registrar (James H. Bundy)
Rep., Con. Educ. (John F. Cudd Jr.)
Rep., Provost's Off. (Murray S. Downs)
5 Student Members

RESEARCH

Faculty:

Ernest Hodgson, *Chairman*
Klaus J. Bachmann
Robert P. Burns
Raymond E. Fornes
Franklin D. Hart
V. A. Hiday
Russ Lea
Thomas LeVere
William H. Johnson
Leonard Pietrafesa
Donald G. Simmons
Edward P. Stahel II, *Senate*
Joan H. Stewart
Paul Z. Zia

Ex officio:

Dean for Research (Henry B. Smith)
Contracts & Grants Officer
(Earl Pulliam)

RESIDENCE LIFE

Faculty or Staff:

Linda S. Dillon, *Chairman*
S. H. Kessler
Rachel K. Kinlaw, *Senate*
Beulah M. Parker
John N. Wall
Thomas E. Wynn

Ex officio:

Rep., Residence Life
(Cynthia Lea Davis-Palcic)
(William W. Guy)
5 Student Members

SAFETY COUNCIL

Faculty or Staff:

Elizabeth Theil, *Chairman*
J. Carl Allred
Don Brazeal
Edward Clark
Roger H. Clark
Paul D. Emerson
Terry E. Frye
Wilton Gower
Don S. Keener
George J. Kriz
Lee R. McDonald
James Reviere
William H. Simpson
Jerry Sprague
David B. Stansel
Richard Sykes
Paul D. West
Porter Williams
Robert T. Williams

Ex officio:

Radiation Protection Off. (L. T. Caruthers)
Assoc. Dir., Occup. Safety & Health
(Donald Gray)
2 Student Members

SCHOLARSHIPS & STUDENT AID

Faculty or Staff:

Eugene J. Kampreth, *Chairman*
George H. Blesiss
Peyton B. Hudson
Loren A. Ihnen
Howard Petrea
Clayton L. Stalnaker, *Senate*
Elizabeth A. Wheeler
Mary L. Walek

Ex officio:

Fin. Aid Officer (Carol O. Eycke)
Assoc. Athl. Dir. (Frank Weedon)
Rep., Alumni Aff. (Bryce R. Younts)
Dir., Admission (Mrs. Anna Keller)
4 Student Members

STUDENT HEALTH

Faculty or Staff:

G. A. Berkstresser, *Chairman*
James S. Brown
Wesley E. Klos
David C. Kradel
Richard A. Lauffer
Peter F. Mulhall
Richard E. Peterson, *Senate*

Ex officio:

Dir., Stu. Health Serv.
(Carolyn S. Jessup)
7 Student Members

TEACHING EFFECTIVENESS
AND EVALUATION

Faculty:

Katherine W. Klein, *Chairman*
Donald A. Emery
William C. Fonteno
B. S. Gupta
D. Lester Holley
Arlene Malinowski
J. Patrick Rand
Alan L. Tharpe
Henry Trussell
George H. Wahl Jr., *Senate*

Ex officio:

Asst. Provost (Murray S. Downs)
Chairman, Academy of Outstanding Teachers (Julie McVay)
Rep., Stu. Aff. (Cynthia Davis-Palcic)
6 Student Members

TRANSPORTATION

Faculty or Staff:

Donald H. Steenson, *Chairman*
Dennis D. Boos
Paul D. Cribbins
Glenn Erwin
W. Perry Pernell
Roger P. Rohrbach, *Senate*
Jo Warren

Ex officio:

Dir. of Trans. (Janis Ross)
Rep., Stu. Aff. (Robert Bryan Jr.)
Rep., Campus Plan. & Constr.
(Judson Newbern)
Rep., Public Safety (Capt. Larry Liles)
4 Student Members

UNIVERSITY DINING

Faculty:

Leonard W. Aurand, *Chairman*
Donald Barnes
Daniel E. Carroll Jr., *Senate*
J. Paul Mueller
Marianne Turnbull
Lynn G. Turner

Ex officio:

Rep., Stu. Aff. (Henry Bowers)
Rep., Univ. Dining (Arthur L. White)
3 Student Members
Chairman, Serv. Comm. of Student Senate
Pres., Univ. Stu. Ctr.

USE OF HUMAN SUBJECTS
IN RESEARCH

Faculty:

	Term Expires
Ian S. Longmuir, <i>Chairman</i>	1984
Maxine P. Atkinson	1986
Edward V. Caruolo	1985
Nathan Garren	1985
Bryan H. Johnson, <i>Senate</i>	1984
James M. Leatherwood	1984
Donald H. Mershon	1986
Jay C. Pass	1983
Tom H. Regan	1986
William H. Sonner	1984
T. Robert Mullinax, <i>Off-campus Rep.</i>	

Ex officio:

Assoc. Dean for Res. (Howard W. Etzel)
Liaison/Admin. (William H. Simpson)
2 Student Members

FACULTY SENATE OFFICE

M. Mohan Sawhney, Chairman
2319 Library
Phone: 2279

Robert M. Fearn, Vice Chairman
18-F Patterson
Phone: 2605

Linda F. Fuller, Secretary
1209 Library
Phone: 3364

Rose M. Autry, Stenographer
2319 Library
Phone: 2279

FACULTY SENATE MEMBERSHIP 1983-1984

Name	Term Ends	School	Address	Phone
Allison, Richard C.	1984	SFR	3036-E Biltmore	3386
Becton, Elwood	1984	G. Const.	216 Harris	2963
Carlton, Charles H.	1985	SHSS	114 Harrelson	2484
Cassel, D. Keith	1985	SALS	2222 Williams	2643
Clark, James W.	1984	SHSS	264 Tompkins	3870
Clark, Roger H.	1985	SD	310-F Brooks	3051
Easley, J. Roger	1985	SVM	4700 Hillsborough St.	829-4200
Fairchild, Erika S.	1985	SHSS	214 Link Bldg.	2481
Fearn, Robert M.	1985	SHSS	18-F Patterson	2605
Franke, John E.	1985	PAMS	224 Harrelson	3200
Fuller, Linda P.	1985	G. Const.	1209 Library	3364
Gurley, Edward D.	1985	SEngr.	312 Mann	2331
Hammett, Wilma S.	1985	SALS	210 Ricks	2770
Johnson, Bryan H.	1984	SALS	231 Polk	2768
Kinlaw, Rachel K.	1984	SALS	F-5 Ricks Annex	2770
Kirsch, Sondra L.	1985	SFR	4008-H Biltmore	3276
Lord, Peter R.	1985	STex.	B-2 Nelson	3481
Marlin, Joe A.	1984	PAMS	223 Harrelson	3200
Miller, Carolyn R.	1984	SHSS	102 Tompkins	3854
Miller, Conrad H.	1985	SALS	212 Kilgore	3167
Mock, Gary N.	1984	STex.	15 Clark	2551
Nagel, Robert T.	1984	SEngr.	2217 Broughton	2365
Peterson, Richard E.	1985	SED.	300-J Poe	2234
Rajala, Sarah A.	1985	SEngr.	335 Daniels	2336
Reid, David W.	1984	PAMS	121 Daniels	2858
Rohrback, Roger P.	1985	SALS	188 Weaver	3101
Sanders, Linda W.	1984	SD	205 Brooks	3051
Saxe, Raymond F.	1985	SEngr.	1122 Burlington	2302
Smallwood, James E.	1985	SVM	4700 Hillsborough St.	829-4200
Smetana, Fred O.	1985	SEngr.	2404 Broughton	2365
Stahel, Edward P. II	1984	SEngr.	308 Riddick	2327
Stalnaker, Clayton L.	1985	SHSS	150 Harrelson	2479
Wahl, George H.	1985	PAMS	527-A Dabney	2941
Walker, N. William	1984	SED.	628-A Poe	2253
Moazed, K. L.	1984	Ex-Officio	2101 Burlington	2932
Winstead, Nash N.		Provost	109 Holladay	2195

FACULTY SENATE 1983-1984

STANDING COMMITTEES

ACADEMIC POLICY COMMITTEE

Kirsch, Sondra L., *Chair*
Carroll, Daniel E.
Cassell, D. Keith
Clark, James W.
Franke, John E.
Hammett, Wilma S.
Mock, Gary N.
Saxe, Raymond F.
Smetana, Fred O.
Stalnaker, Clayton L.
Wahl, George H.

COMMUNICATIONS COMMITTEE

Fearn, Robert M., *Chair*
Allison, Richard C.
Clark, Roger H.
Franke, John E.
Fuller, Linda P.
Johnson, Bryan H.
Miller, Carolyn R.
Mock, Gary N.
Saxe, Raymond F.
Walker, N. William

CONSTITUTION AND BYLAWS COMMITTEE

Lord, Peter R., *Chair*
Becton, Elwood
Carroll, Daniel E.
Clark, Roger H.
Miller, Carolyn R.
Nagel, Robert T.
Peterson, Richard E.
Rohrback, Roger P.
Smallwood, James E.
Stalnaker, Clayton L.
Wahl, George H.

ENVIRONMENTAL POLICY COMMITTEE

Miller, Conrad H., *Chair*
Clark, James W.
Easley, J. Roger
Gurley, Edward D.
Johnson, Bryan H.
Kinlaw, Rachel K.
Peterson, Richard E.
Rajala, Sarah A.
Sanders, Linda W.

EXECUTIVE COMMITTEE

Sawhney, M. Mohan, *Chair*
Moazed, K. L., *Immediate Past Chair*
Fearn, Robert M.
Fuller, Linda P.
Kirsch, Sondra L.
Lord, Peter R.
Marlin, Joe A.
Miller, Conrad H.
Stahel, Edward P. II

PERSONNEL POLICY COMMITTEE

Marlin, Joe A., *Chair*
Becton, Elwood
Carlton, Charles H.
Cassell, D. Keith
Easley, J. Roger
Fairchild, Erika S.
Hammett, Wilma S.
Nagel, Robert T.
Reid, David W.
Rohrback, Roger P.
Smetana, Fred O.

STUDENT AFFAIRS COMMITTEE

Stahel, Edward P. II, *Chair*
Allison, Richard C.
Carlton, Charles H.
Fairchild, Erika S.
Gurley, Edward D.
Hammett, Wilma S.
Rajala, Sarah A.
Reid, David W.
Sanders, Linda W.
Smallwood, James E.
Walker, N. William

ADMINISTRATIVE COUNCIL

Chancellor, <i>Chairman</i>	Bruce R. Poulton
Vice Chancellor and Provost	Nash N. Winstead
Vice Chancellor for Extension and Public Service	W. L. Turner
Vice Chancellor for Finance and Business	George Worsley
Vice Chancellor for Foundations and University Relations	Rudy Pate
Interim Vice Chancellor for Student Affairs	Thomas H. Stafford Jr.
Vice Provost and Dean, Graduate School	Jasper D. Memory
Vice Provost and Dean, Research	Henry B. Smith
Dean, Agriculture and Life Sciences	J. E. Legates
Dean, Design	Claude E. McKinney
Dean, Education	Carl J. Dolce
Dean, Engineering	Larry K. Monteith
Dean, Forest Resources	Eric L. Ellwood
Dean, Humanities and Social Sciences	Robert O. Tilman
Dean, Physical and Mathematical Sciences	Garrett Briggs
Dean, Textiles	Dame Hamby
Dean, Veterinary Medicine	Terrence M. Curtin
Director, Athletics	Willis R. Casey
Coordinator of International Programs	J. Lawrence Apple
University Counsel	Clauston L. Jenkins
Secretary of the University	William H. Simpson
Chairman, Faculty Senate	M. Mohan Sawhney

BUILDING LIAISON PHYSICAL PLANT DIVISION

Building	Building Liaison	Energy Conservation Liaison
Agronomy Greenhouse & Headhouse	R. H. Miller	R. H. Miller
Agri. and Life Sciences Research Annex	D. F. Bateman	D. F. Bateman
Alumni Building		
Alumni Relations	Joyce Marshall	Joyce Marshall
Purchasing	Linda Allred	Linda Allred
Armory Shops Building	Michael D. McGough	Carl Fulp
Athletic Areas (Outside)	Richard Sykes	Richard Sykes
Biltmore Hall	Nancy Roberts	Nancy Roberts
Robertson Wing	Nancy Roberts	Nancy Roberts
Biological Sciences Greenhouse and Headhouse	Robert Aycock	
	Ray Wilder (Alt.)	Ray Wilder (Alt.)
	J. A. Daughtry (Alt.)	J. A. Daughtry (Alt.)
Bostian Hall	C. F. Lytle	C. F. Lytle
Bragaw Hall		
Computer Terminal Room—		
Rm 147	Carl Allred	Carl Allred
Brooks Hall	Winifred Hodge	Don Barnes
Broughton Hall (Including Diesel)	George O. Batton	George O. Batton
Bureau of Mines	J. S. Risley	J. S. Risley
Burlington Nuclear Laboratories		
Computer Terminal Room—Rm 1132	Carl Allred	Carl Allred
Engineering Research	King R. Brose	King R. Brose
Nuclear Engineering		
(Includes Marine Science)	King R. Brose	King R. Brose
Carmichael Gymnasium	Jack Shannon	Jack Shannon
	Elaine Harris	Elaine Harris
Carter Stadium	Richard Sykes	Richard Sykes
Case Athletics Center	Bob Robinson	Bob Robinson
Central Stores	Joe L. Barbour	Joe L. Barbour
Chancellor's Residence	Glenn Ervin	Glenn Ervin
Clark Infirmary	Carolyn Jessup	Carolyn Jessup
Concession Areas (Coliseum, Carter Stadium & Vending Machine Oper.)	Wiley Gouge Jr.	Wiley Gouge Jr.
Cotton/Soybean Lab (Ligon Rd.)	R. F. Wilson	R. F. Wilson
Cox Hall		
Physical & Mathematical Sciences	Leslie B. Sims	Leslie B. Sims
Physics	Tom Hill	Tom Hill
Statistics	Bill J. Stines	Bill J. Stines
Cultural Center	Larry Campbell	Larry Campbell
Dabney Hall		
Biochemistry (Rms. 308, 316, and Cold Room)	Samuel Tove	Samuel Tove
	Joan Johnson (Alt.)	Joan Johnson (Alt.)
Chemistry	Curtis G. Harris	Curtis G. Harris
	Kenneth W. Hanck	Kenneth W. Hanck
Computer Terminal Room—Rm. 120	Carl Allred	Carl Allred
Placement Center	Walter B. Jones	Walter B. Jones
Daniels Hall		
Computer Science	N. F. Williamson	N. F. Williamson
Computer Terminal Room—		
Rm. 118	Carl Allred	Carl Allred
Electrical Engineering	A. J. Goetze	A. J. Goetze
Physics	W. O. Doggett	W. O. Doggett
Research Administration	Vita M. Dick	Martha F. Jackson
University Systems Analysis and Control Center	Darylene Colbert	Darylene Colbert
David Clark Laboratories		
Textiles	Paul D. Emerson	Paul D. Emerson
	W. M. Whaley (Alt.)	
Radiation Safety	L. T. Caruthers	L. T. Caruthers
Dearstyne Avian Research Center		
Physiology Building	R. E. Cook	R. E. Cook
and Nutrition Building	Larry Rozier (Alt.)	Larry Rozier (Alt.)

Building	Building Liaison	Energy Conservation Liaison
Dining Hall	Nida Vance	Nida Vance
Erdahl-Cloyd		
Food Services Area	Art White	Art White
Library	Donald S. Keener	Donald S. Keener
Student Union Area	Henry Bowers	Henry Bowers
	Lee McDonald	Lee McDonald
	Herbert Strickland	Herbert Strickland
North Campus Bookshop	Willard Carpenter	Willard Carpenter
Field House	H. B. Gabriel	H. B. Gabriel
Fraternity Housing	Robert S. Bryan Jr.	Robert S. Bryan Jr.
Gardner Hall (North of Breezeway)	J. G. Vandenbergh	J. G. Vandenbergh
(South of Breezeway)	J. B. Evans	J. B. Evans
Grinnells Animal Health Lab		
Animal Science	E. V. Caruolo	E. V. Caruolo
Harrelson Hall	Janice Mitchell	Janice Mitchell
	Jim Mulholland	Jim Mulholland
Humanities & Social Sciences		
Harris Hall	G. G. Hawkins	G. G. Hawkins
D. H. Hill Library		
Library	Donald S. Kenner	Donald S. Keener
Hillsborough Building		
Administrative Computing Serv.	H. Leo Buckmaster	H. Leo Buckmaster
Computing Center	Carl Allred	Carl Allred
Economics Area	Arthur Coutu	Arthur Coutu
Hillsborough Square	Michael McGough	
Hodges Building	Nancy Roberts	Nancy Roberts
Holladay Hall	Patrice Hill	Patrice Hill
Horticulture Greenhouses & Headhouses	J. C. Taylor	J. C. Taylor
	Thurston J. Mann (Alt.)	Thurston J. Mann (Alt.)
Kilgore Hall	A. A. De Hertogh	A. A. De Hertogh
E. S. King Village	Eli Panee	Eli Panee
Landscape Services Building	Michael D. McGough	Carl Fulp
Laundry	Wilton Gower	Wilton Gower
Leazar Hall		
Computer Science	Harry Kuhman	Harry Kuhman
Dairy Records	O. G. Wall Jr.	O. G. Wall Jr.
Physical Plant	Gary Coates	Carl Fulp
School of Design	Winifred Hodge	Don Barnes
Unassigned Areas	Gary Coates	Gary Coates
Link Building	Joyce Barbour	Joyce Barbour
Mann Hall	P. H. McDonald	P. H. McDonald
McKimmon Center	David Stansel	David Stansel
Method Road Greenhouse Complex	W. H. Johnson	W. H. Johnson
	Neil T. Robertson (Alt.)	Neil T. Robertson (Alt.)
Morris Building (Including Riddick Stadium Stands)	Michael D. McGough	Carl Fulp
Motor Pool	Michael D. McGough	Carl Fulp
Mycotoxin Lab	R. E. Cook	R. E. Cook
	Larry Rozier (Alt.)	
Nelson Building		
Textiles	Paul D. Emerson	Paul D. Emerson
	S. P. Hersh (Alt.)	
1911 Building		
Agriculture		
Humanities & Social Sciences	Ronald Wimberley	Ronald Wimberley
Sea Grant Program	Dr. Ronald G. Hodson	Dr. Ronald G. Hodson
Page Hall	Gilbert Hay	Gilbert Hay
Water Resources Research Inst.	Linda Kiger	Linda Kiger
Park Shop Building		
Industrial Engineering	Darrell B. Rice	Darrell B. Rice
Physical Plant	Michael D. McGough	Carl Fulp
Parking Deck	Sam Penny	Sam Penny
Patterson Hall	E. W. Glazener	E. W. Glazener
Peele Hall	Ronald Butler	Ronald Butler
Phytotron	R. J. Downs	R. J. Downs
Poe Hall	Robert Williams	Robert Williams

Building	Building Liaison	Energy Conservation Liaison
Polk Hall		
Animal Science	Jackie S. Riggsbee	Jackie S. Riggsbee
Biochemistry	Samuel B. Tove	Samuel B. Tove
	Joan Johnson (Alt.)	
Power Plant	Carl Fulp	Carl Fulp
Price Music Center	Perry Watson	Perry Watson
Primrose Hall	W. R. Calloway	W. R. Calloway
Radiation Areas	L. T. Caruthers	L. T. Caruthers
Reclamation Center	Michael D. McGough	Carl Fulp
Residence Halls	William Guy	William Guy
Reynolds Coliseum		
Athletics	Dick Farrell	Dick Farrell
ROTC (Air Force)	Col. Donald Nash	Col. Donald Nash
ROTC (Army)	LTC Martin Anderson	LTC Martin Anderson
Ricks Hall	David Jenkins	David Jenkins
Riddick Lab		
Material Engineering (Includes Annex)	R. F. Stoops	R. F. Stoops
Industrial Engineering	John Ekwall	John Ekwall
Chemical Engineering	Barry King	Barry King
Schaub Food Science Building	Richard R. Earley	Richard R. Earley
Scott Hall	R. E. Cook	R. E. Cook
	Larry Rozier (Alt.)	
Small Animal Facility	Nathaniel Smith	Nathaniel Smith
Snackbar Areas		
Bragaw	Walter Barkhouse	Walter Barkhouse
Quad		
Shuttle Inn		
Syme		
Tunnel Inn		
Sorority Housing	Robert S. Bryan Jr.	Robert S. Bryan Jr.
Students Supply Stores		
Main Store	Doug Small	Willard Carpenter
Frank Thompson		
Craft Shop	Conrad Weiser	Conrad Weiser
Military Supply	Rebecca Griffith	Rebecca Griffith
All other areas	Charles Martin	Charles Martin
Tompkins Hall	Virginia Aldridge	Virginia Aldridge
Turner House	John Dodson	John Dodson
TV Station	Hazel "Mac" Maddrey	Hazel "Mac" Maddrey
	D. Douglas Bullock (Alt.)	D. Douglas Bullock (Alt.)
Universal Equipment Building		
3710 Hillsborough Street	Daryl T. Bowman	Daryl T. Bowman
University Graphics Building	John Lee	John Lee
University Student Center	Henry Bowers	Henry Bowers
	Lee R. McDonald	Lee R. McDonald
	Herbert Strickland	Herbert Strickland
Food Service	Art White	Art White
Student Publications Area	Larry Gracie	Larry Gracie
Varsity Drive Facility		
(Entomology Extension)	R. L. Robertson	R. L. Robertson
Veterinary Medicine School	Daniel J. Moncol	Daniel J. Moncol
Watauga Hall		
Campus Planning	E. F. Harris Jr.	E. F. Harris Jr.
Information Services	Lucy Coulbourn	Lucy Coulbourn
Weaver Laboratories	Robert G. Gaines	Robert G. Gaines
	F. G. Hassler (Alt.)	
Weisiger-Brown	Bob Robinson	Bob Robinson
Weed Control Lab	A. D. Worsham	A. D. Worsham
	Sharon Womack (Alt.)	
Williams Hall		
Crop Science	H. D. Gross	H. D. Gross
	Billy Caldwell (Alt.)	Billy Caldwell (Alt.)
Soil Science	R. H. Miller	R. H. Miller

Building	Building Liaison	Energy Conservation Liaison
Winston Hall		
Humanities & Social Sciences	Ruth Boone	Ruth Boone
Telephone Exchange	Olive Stone	Olive Stone
Withers Hall		
Chemistry	Jimmy Stephenson	Jimmy Stephenson
Marine, Earth and Atmospheric Sciences	Jay Langfelder	Jay Langfelder

ACADEMIC CALENDAR NORTH CAROLINA STATE UNIVERSITY

1983-1984

FALL SEMESTER

Thursday, August 25	Registration Day
Friday, August 26	Change Day (Late Registration, Drop/Add)
Monday, August 29	First day of classes
Monday, September 5	Holiday
Tuesday, September 6	Last day to add a course without permission of instructor
Monday, September 12	Last day to add a course
	Last day to withdraw or drop a course with a refund
	Last day for undergraduate students to drop below 12 hours (NOTE: The tuition and fees charge is based on the number of hours and courses officially carried as of this date)
Monday, September 26	Last day to withdraw or drop a course at the 400 level without a grade, or to change from credit to audit
Friday, October 14	Mid-semester reports due; Fall vacation begins at 10:00 p.m.
Wednesday, October 19	Classes resume at 7:50 a.m.
Friday, October 28	Last day to withdraw or drop a course at the 500 or 600 level
Monday-Friday, October 31-November 11	Preregistration for 1984 spring semester
Wednesday, November 23	Thanksgiving vacation begins at 1:00 p.m.
Monday, November 28	Classes resume at 7:50 a.m.
Friday, December 9	Last day of classes
Monday-Saturday, Monday-Tuesday, December 12-20	Final examinations

SPRING SEMESTER

Monday, January 9	Registration Day
Tuesday, January 10	Change Day (Late Registration, Drop/Add)
Wednesday, January 11	First day of classes
Wednesday, January 18	Last day to add a course without permission of instructor
Wednesday, January 25	Last day to add a course; last day to withdraw or drop a course with a refund; last day for undergraduate students to drop below 12 hours (NOTE: The tuition and fees charge is based on the number of hours and courses officially carried as of this date)
Wednesday, February 8	Last day to withdraw or drop a course without a grade, or to change from credit to audit, at the 400 level or below
Friday, March 2	Mid-semester reports due; Spring vacation begins at 10:00 p.m.
Monday, March 12	Classes resume at 7:50 a.m.
Friday, March 16	Last day to withdraw or drop a course at the 500 or 600 level without a grade
Monday, March 26-	
Friday, April 6	Preregistration for 1984 Fall semester
Monday, April 23	Holiday
Friday, April 27	Last day of classes
Monday-Saturday, Monday-Tuesday, April 30-May 8	Final examinations
Saturday, May 12	Commencement

SUMMER SESSIONS

First Summer Session

Tuesday, May 22
Wednesday, May 23
Thursday, May 24
Monday, May 28

Registration Day
First day of classes
Last day to add a course without permission of instructor
Last day to add a course; last day to withdraw or drop a course with a refund (NOTE: The tuition and fees charge is based on the number of hours and courses officially carried as of this date)
Last day to withdraw or drop a course without a grade, or to change from credit to audit, at the 400 level or below
Last day to withdraw or drop a course at the 500 or 600 level without a grade
Last day of classes
Final examinations

Friday, June 1

Friday, June 8

Tuesday, June 26
Wednesday, June 27

Second Summer Session

Thursday, July 5
Friday, July 6
Monday, July 9
Wednesday, July 11

Registration Day
First day of classes
Last day to add a course without permission of instructor
Last day to add a course; last day to withdraw or drop a course with a refund (NOTE: The tuition and fees charge is based on the number of hours and courses officially carried as of this date)
Last day to withdraw or drop a course with a grade or to change from credit to audit, at the 400 level or below
Last day to withdraw or drop a course at the 500 or 600 level without a grade
Last day of classes
Final examinations

Tuesday, July 17

Tuesday, July 24

Tuesday, August 9
Wednesday, August 10



NORTH CAROLINA STATE UNIVERSITY



Access Key

- can be entered by an individual in a wheelchair with no assistance
- can be entered by an individual in a wheelchair with minimum assistance

N S E W—indicates side of building with accessible entrance

— passenger elevator

■ freight elevator

T accessible toilet

ACCESS

NO. BUILDING NAME

- Alexander Residence
- Alumni Memorial Building
- Bagwell Residence Hall
- Becton Residence Hall
- Berry Residence Hall
- Biltmore Hall
- Bowen Residence Hall
- Bragaw Residence Hall
- Brooks Hall
- Brooks Hall Addition
- Broughton Hall
- Burlington Engineering
- Bureau of Mines
- Carmichael Gymnasium
- Carroll Residence Hall
- Case Athletics Center
- Central Stores
- Chancellor's Residence

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FREQUENTLY CALLED NUMBERS

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This image shows a single page of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or printed text on the page.

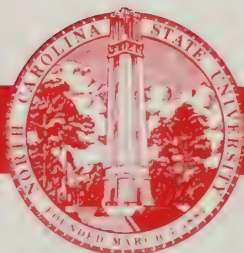
FREQUENTLY CALLED NUMBERS

This image shows a single page of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or printed text on the page.

*95th Annual
Commencement
North Carolina State University*

*Saturday, May 12
Nineteen Hundred and Eighty-Four
Degrees Awarded 1983-84*

CORRECTED COPY



DEGREES CONFERRED



A corrected issue of undergraduate and graduate degrees including degrees awarded June 29, 1983, August 10, 1983, December 20, 1983, and May 12, 1984.

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Musical Program

EXERCISES OF GRADUATION

May 12, 1984

COMMENCEMENT BAND CONCERT: 8:30 a.m.

William Neal Reynolds Coliseum

Eternal Father, Strong to Save Smith

"March" from the Second Suite in F for Military Band Holst

"One for All" Vinter

Mannin Veen Wood

America the Beautiful Ward-Dragon

PROCESSIONAL: 9:00 a.m.

March Processional Grundman

RECESSIONAL:

University Grand March Goldman

NORTH CAROLINA STATE UNIVERSITY COMMENCEMENT BAND

Dr. Frank M. Hammond, Conductor

The Alma Mater

Words by:

ALVIN M. FOUNTAIN

Music by:

BONNIE F. NORRIS, JR., '23

Where the winds of Dixie softly blow
o'er the fields of Caroline,

There stands ever cherished N. C. State,
at thy honored shrine.

So lift your voices; Loudly sing
from hill to oceanside!

Our hearts ever hold you, N. C. State,
in the folds of our love and pride.

Exercises of Graduation

William Neal Reynolds Coliseum

Bruce R. Poulton, Chancellor
Presiding

May 12, 1984

PROCESSIONAL, 9:00 a.m. Frank M. Hammond
Conductor, North Carolina State University Commencement Band
The Audience is requested to remain seated during
the Processional.

WELCOME Chancellor Bruce R. Poulton

NATIONAL ANTHEM Commencement Band

INVOCATION Rev. Charles W. Ward
First Baptist Church, Wilmington St., Raleigh, N. C.

INTRODUCTIONS Chancellor Poulton

ADDRESS Dr. Abraham Holtzman
Professor of Political Science and Public Administration, NCSU

CONFERRING OF HONORARY DEGREE Chancellor Poulton

CONFERRING OF DEGREES Chancellor Poulton
Candidates for baccalaureate degrees presented by
Deans of Schools. Candidates for advanced degrees
presented by Dean of the Graduate School.

ANNOUNCEMENT OF GOODWIFE
GOODHUSBAND DIPLOMAS Kyle Corbin
Salutatorian

ANNOUNCEMENT OF OUTSTANDING
TEACHER AWARDS Richard Glynn Cooper
Valedictorian

RECOGNITIONS Chancellor Poulton

REMARKS William C. Friday
President of The University of North Carolina

ALMA MATER Milton C. Bliss
Assistant Director of Music

The Audience is invited to stand and join in singing
the Alma Mater.

RECESSIONAL

The Audience is requested to remain seated until the
Recessional music is completed.

Commencement Ushers

Army ROTC Ushers

*Tom Barnett
Kathy Barnes
*Maria D. Santiago
Thomas A. Barber
Randy Hillman
Warren Casey
Mark Schlake
Lorrie Overcash
Dan Conway
Michael Gaddy
Michael Riddle
Kenneth Maxwell

Air Force ROTC Ushers

Ronald J. Agar
Robert K.D. Boone
Michael T. Brewer
*Christopher D. Cotts
Roy T. Ellis
Tracey D. Howard
Floyd L. Howell Jr.
Robert L. Jones
*Neal C. Phillips
John D. Spaugh
Jerome Williams
M. Scott Williams

* Also serving as ushers at ROTC Commissioning Ceremony

Commencement Marshals

Sandra Gachinsky
Lisa Gardner
Beth Ann Heiney
Karen Jashinski
Lisa Upchurch
Barbara Wood

Alan Clark
Barry Ellington
David Heller
Marc T. Whitehurst
Scotland Alan May
Curtis M. Hamilton

Social Hour and Distribution of Diplomas

School and Department Locations

School of Agriculture and Life Sciences—11:15 a.m.	
Adult Education—11:45 a.m.	Room 1C-D, McKimmon Center, Western Boulevard
Agronomy, Crop Science and Soil Science	2215 and 2223 Williams Hall
Animal Science	Room 2, McKimmon Center
Biological and Agricultural Engineering	Weaver Laboratories Pavilion
Biological Sciences	2722 Bostian Hall
Biochemistry	
Biological Sciences Major	
Botany	
Ecology	
Entomology	
Genetics	
Microbiology	
Nutrition	
Pest Management	
Physiology	
Plant Pathology	
Toxicology	
Conservation	3712 Bostian Hall and adjacent hallways or 2215 and 2223 Williams Hall
Economics and Business—11:15 a.m.	Main Floor, Reynolds Coliseum
Food Science	105 Schaub-Food Science Building
Horticultural Science	121, 125 and 159 Kilgore Hall
Individualized Study Program	Location of Major Faculty Adviser
Poultry Science	Fairmont Methodist Church Fellowship Hall, 2501 Clark Avenue
Rural Sociology	218 Withers Hall
Zoology	3712 Bostian Hall and adjacent hallways
Fisheries and Marine Biology	
Fisheries and Wildlife Sciences	
Medical Technology	
Wildlife Biology	
Zoology Majors	
School of Design—11:15 a.m.	Stewart Theatre
12:30 p.m. Reception	Brooks Hall
School of Education—11:15 a.m.	
Administration and Supervision	220 Poe Hall
Adult and Community College Education	1C and 1D McKimmon Center
Counselor Education	532 Poe Hall
Curriculum and Instruction and Special Education	412 Poe Hall
Education General Studies	220 Poe Hall

Mathematics and Science Education—	
11:15 a.m. Reception	320 Poe Hall
12:00 noon Diploma Presentation	216 Poe Hall
Occupational Education: Agricultural Education; Health	
Occupations Education; Industrial Arts Education;	
Industrial and Technical Education; and	
Occupational Education	7 and 8 McKimmon Center
Psychology	216 Poe Hall
School of Engineering—11:15 a.m.	
Biological and Agricultural Engineering	Weaver Laboratories Pavilion
Chemical Engineering	115 Riddick Laboratories
Civil Engineering	Lobby of Mann Hall
Electrical and Computer Engineering	Nelson Auditorium
Engineering Operations	242 Riddick Laboratories
Furniture Manufacturing and Management	335 Riddick Laboratories
Industrial Engineering	Ballroom, Faculty Club
Mechanical and Aerospace Engineering	University Student Center Ballroom
Materials Engineering	University Room, Faculty Club
Nuclear Engineering	North Portico, Burlington Engineering Laboratories
School of Forest Resources—11:15 a.m.	Area 1 A and B, McKimmon Center
School of Humanities and Social Sciences—11:15 a.m.	
Economics and Business	Main Floor, Reynolds Coliseum
English, Foreign Languages and Literatures, Philosophy	
and Religion	West Raleigh Presbyterian Church, 27 Horne Street
History	Theatre, Erdahl-Cloyd Union
Political Science—11:45 a.m.	Lobby, Link Building
Sociology	218 Withers Hall
Speech-Communication	G-107 Link Building
School of Physical and Mathematical Sciences—11:15 a.m.	
Chemistry; Marine, Earth and Atmospheric Sciences;	
Mathematics; Physics; and Statistics	124 Dabney
Computer Science	222 Dabney
School of Textiles—11:15 a.m.	Forest Hills Baptist Church
	3110 Clark Avenue

ROTC COMMISSIONING CEREMONY

LIEUTENANT COLONEL MARTIN S. ANDERSON, US Army
Presiding

Stewart Theatre
12 May 1984

PROCESSIONAL MARCH, 2:00 p.m. Dr. Frank M. Hammond
Conductor, North Carolina State University Commencement Band

The Audience is requested to remain seated until Processional music is completed.

NATIONAL ANTHEM

INVOCATION Captain Harland Merriam
*Associate Pastor White Memorial Presbyterian Church
Raleigh, N. C.*

INTRODUCTIONS Dr. Bruce R. Poulton
Chancellor, North Carolina State University

ADDRESS Major General James N. Ellis
*Commanding General US Army Engineer Center & Fort Belvoir,
Fort Belvoir, Virginia*

ADMINISTRATION OF OATH
OF OFFICE Lieutenant Colonel Martin S. Anderson
Professor of Military Science
Lieutenant Colonel Donald S. Nash
Professor of Aerospace Studies

PRESENTATION OF CERTIFICATES Major General James N. Ellis

BENEDICTION Captain Harland Merriam

RECESSIONAL

The Audience is requested to remain seated until the Recessional music is completed.

Academic Costume

Academic gowns represent a tradition handed down from the universities of the Middle Ages. These institutions were founded by the Church; the students, being clerics, were obliged to wear the prescribed gowns at all times. Round caps later became square mortarboards; the hoods, originally cowls attached to the gowns, could be slipped over the head for warmth.

Many European universities have distinctive caps and gowns which are different from those commonly used in this country. Some of the gowns are of bright colors and some are embellished with fur. A number of these may be noted in the procession.

The usual color for academic gowns in the United States is black. The bachelor's gown is worn closed, the master's and doctor's may be worn open or closed. The shape of the sleeve is the distinguishing mark of the gown: bachelor—long pointed sleeves; master—oblong, square cut in the back with an arc cut away in front; doctor—bell shaped.

Caps are black. The tassels for the Ph.D. degree are gold and those for other graduate and professional degrees may be of the color corresponding to the trimmings on the hoods. The color of the tassels for bachelor's degrees indicates the curriculum of the graduate: Agriculture, maize; Design, brown; Education, light blue; Engineering, orange; Forest Resources, russet; Liberal Arts, white; Physical and Mathematical Sciences, yellow; Textiles, wine red.

Of all the components of the academic costume, the hood bears the heaviest symbolic burden. The hood must make clear the level of the degree, the faculty in which it was given, and the institution which awarded it. The level of the degree is shown by the size of the hood, the width of the velvet trimming, and in the case of doctors, by the shape. The bachelor's, master's, and doctor's hoods are three feet, three and one-half feet, and four feet long, respectively. The velvet trimming in the same order is two, three, and five inches and extends all around the hood on the exposed edge. This same trimming identifies the faculty in which the degree was awarded. For each faculty there is a corresponding color; so a glance at the trimming is all that is needed to identify the faculty. A *partial* list of the colors follows: Agriculture, maize; Architecture and Art, brown; Science, golden yellow; Economics, copper; Education, light blue; Engineering, orange; Forestry, russet; Physical Education, sage green; Religion, scarlet; Speech, silver gray; Veterinary Medicine, gray; Textiles, wine red. The following faculties have the same color—dark blue: Anthropology, History, Languages, Literature, Philosophy, Political Science, Sociology.

Academic Honors

Honors participants benefit from a more individualized and rigorous approach to their desired degree through special classes, seminars and individual research.

Undergraduate degree honor designations are:

Cum Laude—for GPA 3.250 through 3.499

Magna Cum Laude—for GPA 3.500 through 3.749

Summa Cum Laude—for GPA 3.750 and above.

UNDERGRADUATE DEGREES

School of Agriculture and Life Sciences



BACHELOR OF SCIENCE IN BIOLOGICAL AND AGRICULTURAL ENGINEERING

Jointly administered by the School of Agriculture and Life Sciences and the School of Engineering. See page 18 under the School of Engineering for a listing of the graduate seniors in the jointly administered program.

BACHELOR OF SCIENCE IN CONSERVATION

Jointly administered by the School of Agriculture and Life Sciences and the School of Forest Resources.

Degrees Conferred August 10, 1983

John Charles Hall	Sanford
Ephraim Ahizechukwu Okafor	Iwo, Nigeria
Rachel Charlotte Sanborn	Havelock

Degrees Conferred December 20, 1983

Michael Kent Clary	Raleigh
***Elizabeth Ann Hardin	Raleigh
Debra Lynn Ryals	Raleigh
Lawrence Willard Walker, Jr.	Raleigh

Degrees Conferred May 12, 1984

Curtis Harrison Armstrong	Spring Hope
H Kevin Charles Martin	Hildebran

BACHELOR OF SCIENCE IN AGRICULTURAL ECONOMICS

Degrees Conferred June 29, 1983

Gregory Thomas Cima	Chapel Hill
*Timothy Everett Davidson	Colerain
Randal David Hancock	Siler City
Gregory John Langelier	Salisbury, MD
Tommy Stanley Watson	Mt. Airy

Degrees Conferred August 10, 1983

Stephen Guy Kinzler	Carnegie, PA
Michael Roland Molesky	Wilson
†Melanie Jan Shaffer	High Point

Degrees Conferred December 20, 1983

†Susan Harrell Fleming	Wilson
James Howard Ham	Snow Hill
Daniel Mark Jones	Cofield
Cynthia Ann Moore Padgett	Burlington
Charles Todd Parker	Harmony
Roy Vernon Tew, III	Dunn
Charles William Woodruff, Jr.	Wilkesboro

Degrees Conferred May 12, 1984

Paul Cleveland Askew	Gatesville
Cynthia Marie Bradley	Clifton Park, NY
*William Bennett Bradley	Tarboro
†Steven Walter Brooks	Pittsboro
Javier Angel Gomez-de-la-Lama	Raleigh
Brian Earl Koonce	Hyattsville, MD
Dwayne Alan Lobdell	Deposit, NY
Kevin Lynn Moore	Roxboro
Scott Joseph Padgett	Greensboro
Robert Stokes Phillips	Jobstown, NJ
Van Banum Powell	Wilson

BACHELOR OF SCIENCE IN AGRONOMY

Degree Conferred June 29, 1983

H**David Herring Hardy	LaGrange
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Degrees Conferred August 10, 1983

Steven Dennis Sumner	Como
Martha Cameron Willcox	Winston-Salem

Degrees Conferred December 20, 1983

Clyde Wesley Adcock	Oxford
Larry Arnold Brown	LaGrange
Danny Mason Clayton	Belhaven
**Richard Manly Edmund, Jr.	Chadbourn
Cathy Marcel Herring	LaGrange
David Henry Petree	Rural Hall
Bennie Barton Roberson	Hamilton
Thomas Anthony Tucker	Greensboro
Philip Martin White	Dobson
***Brian Arthur Wood	Warne
Stephen Craig Woodruff	Boonville

Degrees Conferred May 12, 1984

Robert Stephen Adcox	Battleboro
James Lee Beeson	Summerfield
Ann Cululi	Bethlehem, PA
Mark Bradley Cummings	Raleigh
David Lynn Dycus	Sanford
Marshall McNeill Newton	Raeford

† Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

**Louis Craig Pierce	Pikeville
†Wendall Scott Weathington	Roseboro
Franklin Owen Williams	Wallace
William Henry Winslow	Hamilton

BACHELOR OF SCIENCE IN ANIMAL SCIENCE

Degrees Conferred June 29, 1983

Laura Helen Buchanan	McMurray, PA
*Barbara Ann Butler	Raleigh
Nancy Jean Byrnes	Wilmington
*Jonathan Allen Gladden	Vale
Johnny Frank Hodges	Dunn
†Amy Lee McGuire	Greensboro
H**Mona Denise Robertson	Charlotte
H***Dana Whitener	Salisbury
Paul Wesley Wilson	Sanford

Degrees Conferred August 10, 1983

Rexann Ballard	Asheville
Sharon Gray Bill	Fayetteville
†Melanie Jan Shaffer	High Point
Kevin Michael Swann	Newport
Amanda Lynn Tally	Winston-Salem

Degrees Conferred December 20, 1983

*Joni Moore Barnhardt	Burlington
Harold Douglas Bivins	Hillsborough
Janice Renee Braxton	Snow Camp
Jeffrey Scott Carpenter	Cherryville
†Susan Harrell Fleming	Wilson
†Laura Dugger Forbes	Boone
H***Michael Patrick Gallup	Raleigh
William Nelson McDuffie, Jr.	Robbins
†James Charles Moore	North Wilkesboro
*John Norman Norton, II	Thomasville
*Julia Margaret Rand	Wilson
Cathleen Anne Rubens	Raleigh
*Shawnee Lee Sloop	Elkin
Cindy Suzanne Warlick	Sanford
Vance Junious Williams	Deep Run

Degrees Conferred May 12, 1984

Timothy Dewayne Avants	Bahama
David Benton Baker	Four Oaks
†H**Michael Ralph Brasche	Charlotte
†Steven Walter Brooks	Pittsboro
Gregory Lynn Butler	Roseboro
William Edward Byers	Lincolnton
Carolyn Marie Clymer	Greensboro
H*Elizabeth Zoé Faulstich	Charlotte
H*Jennifer Susan Foshee	Raleigh
John Wallace Foushee, III	Roxboro
James Robert Fowler, III	Zebulon
Jenny Annette Hagler	Concord
Timothy Ray Hollowell	Rich Square
Laura Anne Jessup	Burlington

† Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

H***Ronald Earl Johnson, Jr.	Pink Hill
Charles Atlee Jonson	Cary
†Lisa Rachael Klimek	Gastonia
H**Kim Neal McCann	Winston-Salem
Mark Allen McMahon	Morganton
Rodney David Metters	Lexington
Donald Lynn Miller	Raleigh
Steven Boyd Moye	Goldsboro
*Amy Elizabeth Poteat	Rutherfordton
Anne Flora Radintz	Statesville
H*Juliet Lynn Reeves	Raleigh
H***Suzanne Riley Sewell	Zebulon
Burlon Monique Sinclair	Hendersonville
*Abbie Jeanene Smith	Shelby
Michael Scott Thamm	Groton, CT
†Mark Dennis Thompson	Oakboro
H*David Michael Tillson	Jamestown
Lisa Frances Tucker	Pilot Mountain
Norma Phillips Underwood	Troy
Stephen Vernell Vick	Tarboro
†Sabrina Darlene Vogler	Mebane
†Wendall Scott Weathington	Roseboro
Nancy Joan Welch	Charlotte
James Benton Williams	Cleveland
Nancy Jo Williams	Olin
Ted Michael Williams	Olin
†H*Kevin Protus Wood	High Point

BACHELOR OF SCIENCE IN BIOLOGICAL AND AGRICULTURAL ENGINEERING

Degrees Conferred June 29, 1983

Keith Neil Lemly	Fleetwood
Lee Edward Robinson	Newton

Degrees Conferred December 20, 1983

Dwayne William Beeson	Kernersville
Richard Duty Currin, Jr.	Oxford
John Thomas Dalrymple	Broadway
David Ross Thomas	Sanford
Norris Craig Wilson	Statesville
Timothy William Woody	Durham

Degrees Conferred May 12, 1984

Dewey Calhoun Adcock	Whitakers
†H**Michael Ralph Brasche	Charlotte
†*James William Gore, Jr.	Tabor City
Wilson Muthamia Kairanya	Meru, Kenya
Grady Douglas Parker	Cullowhee
Jeffrey Jay Renn	Franklinton
Fredrick Ashburn Rich	Mocksville
**Timothy Richard Seaboch	Salisbury
Timothy Edmond Simpson	Marshville
H**William Henry Sparrow, Jr.	Durham
David Lynn Thomas	Lillington
Julian David Wheless	Bunn

BACHELOR OF SCIENCE IN BIOLOGICAL SCIENCES

Degree Conferred June 29, 1983

*Deborah Joy Rea Charlotte

Degrees Conferred August 10, 1983

Valerie Palumbo Hovis Cary
Minaxiben Patel Kabwe, Zambia

Degrees Conferred December 20, 1983

Michael Scott Blau Sharon, MA
*Bruce Dean Council Cary
David Alan Hardin Forest City
Kimberly Jean Whitehead Whiteville

Degrees Conferred May 12, 1984

H*John Edward Connelly Allentown, PA
Patti Blanche Davis Conway
H Lisa Dawn Gates Pensacola, FL
Toni Andrea Gore Bolivia
Debora Jan Gurganus Plymouth
Sue Ann Butterworth Hurlbert Raleigh
Scott Harold Leadbeater Haddon Heights, NJ
Karen Rolin Odom Raleigh
H*Karla Michelle Pace Spring Hope
Martha Jo Rosser Sanford
†Jerri Bea Thigpen Beulaville
†Lorna Leigh Vaughan Bon Air, VA

BACHELOR OF SCIENCE IN BIOLOGICAL SCIENCES (Biochemistry)

Degrees Conferred June 29, 1983

Lee Cartwright Leonard Sanford
†Mara Olivia Massel Raleigh

Degree Conferred August 10, 1983

*John Norman Norton, II Thomasville

Degrees Conferred December 20, 1983

***Kevin Michael Groch Michigan City, IN
Tory Martin Hagen Kings Mountain
Edward Lee Hanson Raleigh
Mary Elizabeth Miller Lexington
John Adrian Moorefield Matthews

Degrees Conferred May 12, 1984

†Tammie Sue Bernard Oxford
†H Susan Elaine Danchi Carrboro
†David Anthony Hedeon Raleigh
Pamela Diane Ingle Burlington
*Sherrie Renee Massey Princeton
*Patricia Ann McKone Southern Pines
Jack Alan Menius, Jr. Raleigh
H***Sarah Ruth Oliver Sparta

**Kathy Ann Rash	Statesville
Kyle Long Rudd	Burlington
Katherine Lynn Russin	Endicott, NY

BACHELOR OF SCIENCE IN BIOLOGICAL SCIENCES (Microbiology)

Degree Conferred August 10, 1983

Fredric Mark Tutwiler	Raleigh
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Degrees Conferred December 20, 1983

Robert Stephen Blackman	Raleigh
Martha Gray Mewborn	Trenton
*Mary Sims Meyer	London, OH
†Jeffrey Michael Rhodes	Charlotte
Lynda Ann Summy	Raleigh

Degrees Conferred May 12, 1984

John Charles Davison	Garner
†Lisa Ann Jones	Advance
H***Patricia Anne Spears	Goldsboro

BACHELOR OF SCIENCE IN BIOLOGICAL SCIENCES (Nutrition)

Degree Conferred December 20, 1983

Roy Clifton Daniel	Fuquay-Varina
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BACHELOR OF SCIENCE IN BOTANY

Degree Conferred June 29, 1983

***Andrew Owen Brightman	Charlestown, RI
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Degree Conferred August 10, 1983

Anita Louise Fonseca	North Bergen, NJ
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Degree Conferred December 20, 1983

†*Barbara Jean Hansen	Wilmington, DE
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Degrees Conferred May 12, 1984

**Tracie Lynn Bradshaw	Morganton
Phillip Anthony Conti	Raleigh
Phillip Lee Wilson	Goldsboro
†***Elaine Janine Wolf	Cleveland, OH

BACHELOR OF SCIENCE IN FISHERIES AND WILDLIFE SCIENCES

Degree Conferred June 29, 1983

**Howard Andrew Phillips	Morehead City
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Degrees Conferred December 20, 1983

Kennard Shields Trowbridge, III	Washington
*Todd Clifford Wenzel	Milwaukee, WI

Degrees Conferred May 12, 1984

**Donald Hayes Cockman	Robbins
*Raymond Patrick Hawks	Mt. Airy

† Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

H***Gregory Edd Little	Monroe
Mark Steven McKellar	Red Springs

BACHELOR OF SCIENCE IN FOOD SCIENCE

Degree Conferred June 29, 1983

Elizabeth Ann Collins	Morganton
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Degree Conferred August 10, 1983

Marcia Nell Wilson	Cary
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Degrees Conferred December 20, 1983

Steven Wright Bowen	Raleigh
Joan Elizabeth Hardy	Roanoke Rapids
Dawn Elizabeth Koonce	Trenton
Martha Lou Leonard	Louisburg
Timothy Roy Martin	Eagle Springs
Wanda Annette Martin	Wadesboro
Jean Mildred Myers	Winston-Salem
Linda Teresa Powell	Raleigh
*Stephen Michael Tracey	Greensboro
†Mattie Marie Williams	Warrenton

Degrees Conferred May 12, 1984

James Ray Ball	New Hill
Medard Boniface Byamungu	Bukoba, Tanzania
Joseph Emery Colquitt	Siler City
Robert Joseph Contino	Bridgeton, NJ
Joyce Elizabeth Hobbs	Anne Arundel, MD
Martha Ingram Jones	Mt. Olive
H*Rose Marie Martinez	Jacksonville
Betty June Parker	Clinton
Rafael Emilio Pérez	Medellin, Colombia
***Rhonda Ruth Price	Lancaster, SC
H Patricia Lynne Stinson	Winston-Salem

BACHELOR OF SCIENCE IN HORTICULTURAL SCIENCE

Degrees Conferred August 10, 1983

John Anthony Dumproff	Lincolnton
*Robert Stanley Hayter	Southern Pines
James Alonzo King	Waynesville
Cassandra Dixon Morgan	Robersonville
Johan Thompson Newcombe	Gastonia

Degrees Conferred December 20, 1983

George Herring Bowen	Raleigh
Elizabeth Ann Emery	Ashland, OH
Darcy Shawn Geiger	Asheboro
†*Barbara Jean Hansen	Wilmington, DE
Diana Lynn Price Harrell	Jacksonville
Barbara Sue Hughes	Angier
Martin Myles Hutzel	Raleigh
Steven Lee Ingold	Carthage
Juliana Lynne King	Warwick, NY
Thomas Weaver Lee	Raleigh

Dana Neal Martin	Eagle Springs
Thomas Benjamin Persinger	Richlands, VA
Kais Sadik	Woodland, CA
Sharon Layne Sanders	Zebulon

Degrees Conferred May 12, 1984

Ricky Alan Barrier	Salisbury
Van Blake Edwards	Raleigh
Mary Carla Gunter	Sanford
Mitchell Stewart Hayes	Morrisville
Karen Perry Hight	Sanford
Susan Lynn Jennings	Chapel Hill
H David William Knox	Hendersonville
Ellis William Lay	Tabor City
Brian James McCall	Flat Rock
Scott Edward Miller	Lexington
Janet Kay Morris	Durham
David Joseph Ostrich	Reston, VA
Marvin Bruce Owen	Greenville
Sara Anne Parker	Raleigh
Joel Lynn Parlier	Statesville
Arty Gordon Schronce	Iron Station
David McCulloh Shriver	Westminster, MD
†Charles Neal Stewart, Jr.	Winston-Salem
Ezra Carl Tatum, III	Cooleemee
Mary Margaret Tilley	Mt. Airy
Charles Robert Walker, III	Kings Mountain
John Blair Watson	Columbus, GA
Debra Ann West	Fayetteville
†***Elaine Janine Wolf	Cleveland, OH
*Mark Stephen Young	Burnsville

BACHELOR OF SCIENCE IN PEST MANAGEMENT FOR CROP PROTECTION

Degree Conferred August 10, 1983

John Kevin Wilson	Raleigh
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Degrees Conferred December 20, 1983

William Kenneth Crabtree	Clayton
***Richard Jay Sloane	Los Angeles, CA

Degrees Conferred May 12, 1984

Daryl Stephen Bergeron	Goldsboro
Timothy James Blenk	Goldsboro
William Gordon Bynum	Chapel Hill
*Lisa Peatross Schell	Raleigh

BACHELOR OF SCIENCE IN POULTRY SCIENCE

Degrees Conferred June 29, 1983

Christopher Scott Askew	Fayetteville
William Hal Queen	Mooresville
Charles William Woodruff, Jr.	Wilkesboro

Degree Conferred August 10, 1983

Art Vandolph Threatt	Marshville
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Degrees Conferred December 20, 1983

Neal Franklin Eller	Ferguson
Linda Gail Gregory	Wilkesboro
†James Charles Moore	North Wilkesboro
Kenneth Ray Price	Siler City

Degrees Conferred May 12, 1984

Mary Stephanie Beretich	Clinton
James Douglas Clements	Monroe
Brenda Faye Dixon	Bethel
Susan Alexandra Lewis	Hickory
Valorie Chesson McCoy	Hamlet
Jerry Eugene Moore	Marshville
H Dorothy Lynn Murray	Raleigh
H*Shawnee Lee Sloop	Elkin
†Mark Dennis Thompson	Oakboro
Dennis Craig Williams	Fayetteville

BACHELOR OF SCIENCE IN RURAL SOCIOLOGY

Degree Conferred December 20, 1983

Sandra Lynne Walker	Ennice
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Degrees Conferred May 12, 1984

George Ernest Brinton	Bowie, MD
Ernest Thurman Driver, III	Knightdale
James Alton McKenzie	Mooresville

BACHELOR OF SCIENCE IN SOIL SCIENCE

Degrees Conferred December 20, 1983

Helen Ann Keith	Fuquay-Varina
**Charles William Long, Jr.	Lexington
Linda Darlene Monds	Elizabeth City
*Amanda Jane Tomlin	Fairfax, CA

Degrees Conferred May 12, 1984

Richard Wayne Griffin	Elizabeth City
Brenda Elaine Perkins	Havelock

BACHELOR OF SCIENCE IN WILDLIFE BIOLOGY

Degree Conferred June 29, 1983

Ruth Suzanne Raudebaugh	Fayetteville
-------------------------------	--------------

Degrees Conferred December 20, 1983

Daudi Mainza Chimbali	Chilanga, Zambia
**William Herrick Steinhagen	Cary

Degrees Conferred May 12, 1984

Nancy Jo Bell	Greensboro
Mark William Frey	King of Prussia, PA
Kendall Wade Johnson	Burlington

BACHELOR OF SCIENCE IN ZOOLOGY

Degrees Conferred June 29, 1983

James Earl Beasley, Jr.	Broadway
Connie Maranne Carroll	Durham
Pamela Kay Fisher	Weaverville
†Amy Lee McGuire	Greensboro

Degrees Conferred August 10, 1983

Michelle Marton Bridges	Shelby
Robert Eugene Hester	Rocky Mount
Alma Elizabeth Kegelmeyer	Fayetteville
Luis Gilberto Morales	Greenville
James Alexander Williams	Yanceyville

Degrees Conferred December 20, 1983

James Gordon Bethune	Southern Pines
H***Robert Charles Bledsoe	Raleigh
Stephanie Marie Bowles	Sneads Ferry
H*Darcie Baier Byers	Chapel Hill
Beverly Frances Edwards	Raleigh
Herbert Linwood Ellington	Raleigh
†Laura Dugger Forbes	Boone
*Sandra Lee Harris	Waco, TX
David Anthony Hedeon	Raleigh
†Mark Garland Johnson	Durham
H***Steven Andrew McCollum	Raleigh
Clifford Ray McNeely	Charlotte
Robert Charles Menches	Cary
Brenda Carroll Morris	Tarboro
Kimberly Marie Oliver	Cary
Pamela Diane Phillips	Marshville
†Jeffrey Michael Rhodes	Charlotte
Angela Dawn Sanders	Four Oaks
Steve Richard Sedlacek	Pittsburgh, PA
Alisa Dale Strickland	Four Oaks
***Rebecca Creech Tart	Benson
David Michael Tillson	Jamestown
†Mattie Marie Williams	Warrenton

Degrees Conferred May 12, 1984

Katherine Michiko Abe	Greensboro
***Angela Leigh Adams	Dobson
Debra Ann Adams	High Point
Susan Elaine Adams	Charlotte

† Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

Larry Neil Alexander	Winston-Salem
Rodney Holt Allen	Fayetteville
Karen Ann Basinger	Concord
H Scott Douglas Beane	Lenoir
H**Lisa Rochelle Beck	Clearwater, FL
Peer Jon Beveridge	Lebanon, NJ
Gordon Milton Braley	Garner
H**Laurel Denise Brooks	Clayton
*Alison Lynn Brown	Littleton, CO
H Cresada Angela Buchanan	Greensboro
Krista Taylor Carlson	Jackson, NJ
**Morgan Keith Chaffin	Mocksville
Ann Louise Craddock	Graham
Laura Kay Dahl	Pinehurst
Elizabeth McCall Davis	Timonium, MD
Ronald Gerard Davis	Fayetteville
Sean Michael Dowd	Andover, MA
Margaret Ann Edmondson	Enka
Stanley Eugene Ferrell	Raleigh
***Patricia Anne Fitzgerald	Green Bay, WI
Edward Franklin Foster, Jr.	Gold Hill
Selena Gail Freeman	Pineville
***Mary Lynn Gulledge	Morven
Natalie Wade Harn	Clemmons
H**Catherine Moyer Hethcock	Raleigh
**Robert Mark Hoyle	Rutherfordton
*William Pitt Isley	Wilmington
Paul Brian Jackson	Dunn
Lisa Marlene Jeffreys	Raleigh
Donna Elaine Jenkins	Newland
†Lisa Ann Jones	Advance
Roscoe Blaine Jones	Garner
*Robert Joseph Keating	Cary
Cathy Denise Killian	Hickory
Dina Michele Lawrence	Kannapolis
Lorrie Ann Link	Wilkesboro
Deidre Frances Lozares	Raleigh
Wallace Berry Maultsby, Jr.	Troy
*Mary Lynne McElhaney	Athens, OH
Daryl Scott McGee	Winston-Salem
Perry Say Melton	Spindale
H*Susanna Hart Miller	Asheville
Nina Estella Monroe	Eagle Springs
H*William Todd Overcash	Albemarle
H**Steven Thomas Pantelakos	Fayetteville
Kathryn Leigh Patseavouras	High Point
†H*Charles David Pendleton	Fayetteville
*Debra Ann Peters-Martin	Fayetteville
H***John Yancey Phelps, III	Raleigh
*Jane Elizabeth Pixley	Charlotte
**David Gene Polhemus	Raleigh
H*Ann Robin Ratchford	Dallas
H**Patricia Ellen Rynders	Raleigh
Stuart Fredric Sayles	Livonia, MI
*James Eugene Schacht	Charlotte
Maria Darene Sena	Asheboro
*John Patrick Soles	Raleigh

† Co-major

* Cum Laude

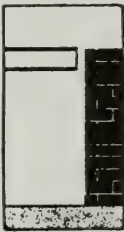
** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

Tonya Naomi Templeton	Raleigh
Colon Lee Terrell	Denton
†Jerri Bea Thigpen	Beulaville
*Heath Carl Thomas	Greenville
Jeffery Todd Toves	Fayetteville
David Simmons Tucker	Raleigh
†Sabrina Darlene Vogler	Mebane
Leigh Allison Warren	Statesville
†H*Kevin Protus Wood	High Point
Leslie Ann Woods	Chapel Hill
Julen Endika Zubizarreta	Caracas, Venezuela

School of Design



BACHELOR OF ENVIRONMENTAL DESIGN IN ARCHITECTURE

Degree Conferred June 29, 1983

Christopher Henderson	Statesville
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Degrees Conferred August 10, 1983

**Jonathan Bidwell Graham	Raleigh
*Kevin Michael Kane	Cullowhee
Gary Eugene Mertz	Raleigh
Steven Kenneth Schiller	Seattle, WA
**Jane Josephine Willeboordse	Columbia, MD
Carolyn Louise Williams	Miami, FL

Degrees Conferred December 20, 1983

Bruce Forrest Bowman	Wilmington
John Michael Brooks	Goldsboro
Aymez Coromoto Castro-Baez	Caracas, Venezuela
Donald Charles Etheridge	Kenly
William Charles Haverly	Delmar, NY
James Wheeler McKay, Jr.	Concord
*Anthony David Myers	Nassau, Bahamas
†Mark Benjamin Patterson	Dobson
James Walton, IV	Burlington
Jeffrey Brent Yelton	Charlotte

Degrees Conferred May 12, 1984

**Susan Emerick Abed	Durham
**Marty Allen Beal	Maiden
**Benjamin David Benson	Greensboro
**John Dellinger Blackmon	Charlotte
*Alan David Bolzan	Raleigh
Ruth Huisingh Bryant	Willmar, MN

† Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

*Benjamin Barry Cahoon	Engelhard
Scott Leon Cornelius	East Bend
James Henry Daughtrey	Gatesville
*Christopher Vaughan Downey	Raleigh
***Edward Kent Hodges	Raleigh
Steven Kent Holliday	Rural Hall
Douglas Alan Kuhns	Rocky Mount
***Kevin Wayne Milstead	Rockingham
Jeffrey Scott Morgan	Roanoke Rapids
Thomas Dalton Miller Nicholson	Charlotte
**Fayma Johnson Nye	Raleigh
Epifanio Louis Pazienza	Bloomfield, NJ
Alwyn Howell Phillips, III	Rocky Mount
Vikram Amar Sen	Wilson
**Dennis Edward Stallings	Melbourne, FL
*Frederick Eugene Taylor	Hendersonville
*Jay Arthur Waronker	Atlanta, GA
**Mark James Wettstone	Atlanta, GA
**David Bradbury Wilbourne	Richmond, VA
Frank McCrady Williams, II	Matthews
Julia Leigh Wilson	Statesville
***Scott Alan Wolf	New Carrollton, MD
Phillip Zook	Reedville, VA

BACHELOR OF ENVIRONMENTAL DESIGN IN LANDSCAPE ARCHITECTURE

Degrees Conferred June 29, 1983

Susan Janet Botts	Riverdale, ND
Christine Marie Lockwood	Charlotte

Degrees Conferred December 20, 1983

Julia Springer Stack	Martinsville, VA
Susan Kelley Ray Wescoe	Herndon, VA

Degrees Conferred May 12, 1984

*Sylvia Lee Cobb	Durham
Keith Howard MacVean	Tryon

BACHELOR OF ENVIRONMENTAL DESIGN IN PRODUCT DESIGN

Degrees Conferred June 29, 1983

David Wayne Curtis	Eglin AFB, FL
James Frederick Dean	Raleigh
Wilma Alycia Dobson	Winston-Salem
Allan Craig McDuffie	Wilmington
Stephen Kent Powell	Burgaw
Luanne Carol Price	Black Mountain
Carl Woodrow Wellborn	Baltimore, MD

Degree Conferred August 10, 1983

John David Nedwidek	Cary
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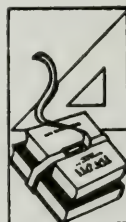
Degrees Conferred December 20, 1983

*Diana Reneé Boger	Easton, PA
Keith Donald Bohn	Winston-Salem
Toni Lynn Bowerman	Raleigh
Joseph Warren Easter, III	Hamlet
**Sue Hall	Raleigh
Bambi Jean Orban	Raleigh
Sheri Jean Rowe	Burnsville
Rachel Elizabeth Shook	Goldsboro
*Michael David Walters	Shelby
*Charlotte Anne White	Cary

Degrees Conferred May 12, 1984

*Martha Cox	Matthews
Donald Mark Drye	Elkhart, IN
Peter Nils Eichenberger	Raleigh
Frank Stanhope Elder	Charlotte
David Wayne Evans	Lanham, MD
*Katherine Barrett Glans	Matthews
Christine Elizabeth Henry	Chapel Hill
Miles Steven Lewis	Charlotte
*Christopher McCormick	Raleigh
*Tristan Alfonso Merino	Raleigh
John Calvin Taylor	Knightdale

School of Education



BACHELOR OF ARTS IN PSYCHOLOGY

Degrees Conferred June 29, 1983

Hal Buckner Farthing	Holly Springs
Thomas Howard Griffin	Pilot Mountain
John Elwood McNinney	Trenton, NJ
Cynthia Marie Varner	Smithfield

Degrees Conferred August 10, 1983

Janet Waite Ostinelli	Winona, MN
Nancy Jean Petrucka	Rutherfordton
Martha Barnes Pope	Smithfield

† Co-major

* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

Degrees Conferred December 20, 1983

*Julie Harwell Huneycutt	Raleigh
*Marilyn Blake Kindsvater	Raleigh
Thomas Arthur Koop	Raleigh
Candace Lea Mushlitz	Asheville
Patricia Mae Pearsall	Goldsboro
Margaret Acree Purser	Raleigh
Allan David Rogers	Havelock
John Nathaniel Scott	Cameron
*Judy Lybrand Swenson	Wagener, SC
*Lisa Jean Thompson	Winston-Salem
*Wanda Stark Zoellner	Raleigh

Degrees Conferred May 12, 1984

Eric Lee Allen	Goldsboro
Thomas Anthony Ballis	Knoxville, TN
Louise Anntoinette Braswell	Goldsboro
Spyridoula Evangelia Capetanos	Raleigh
***Julia Shea Gallinat	Lynchburg, VA
Susan Kay Harrington	Cary
James Alvin Higgins, Jr.	Winston-Salem
*Larry Charles Hovis	Charlotte
*Frederick Scott Hunter Krauss	Waynesville
Teri Lynn Rawls	Raleigh
Nafisa Lee René	Cary
Winston Courtney Sadler	Winston-Salem
Gustavo Adolfo Saldias	Raleigh
Mary Elsie Daisey Sbaiti	Raleigh
Janie Elizabeth White	Raleigh
***Gloria McCallister Williams	Raleigh

BACHELOR OF SCIENCE IN EDUCATION

Agricultural Education

Degree Conferred June 29, 1983

Garland Edward McCollum	Madison
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Degrees Conferred December 20, 1983

Robert Woolard Clark, Jr.	Everetts
***Randy Lee Cruse	Albertson
William Lane Dickens	Fuquay-Varina
David Manning Huie	Union Grove
Jimmy Lewis Martin	Mt. Olive
William Leon Powell	Shawboro
Susan Marie Wood	New Bern

Degrees Conferred May 12, 1984

James Ronald Ansley	Gaston
John Flake Brantley	Mooreville
Julie Reneé Capps	Princeton
Daniel Edward Gordon	High Point
†*James William Gore, Jr.	Nakina
Roberta Michele Grady	Seven Springs
*Vernon Glenn Howell	Mill Creek
Donald Garrett Lee	Four Oaks

**Craig Joseph Mayes	Kings Mountain
Gregory Daryl Oliver	Boonville
Phyllis Annette Owens	Rutherfordton
*Larry Kendall Parker	Four Oaks
Keith Allen Pelletier	La Grange
Kenneth Earl Rogers	Denton
Michael Craig Senter	Fuquay-Varina
James Everette Sheffield, Jr.	Biscoe
Joseph David Steed, III	Candor
Michael Shawn Stephenson	Four Oaks
†Charles Neal Stewart, Jr.	Winston-Salem
Elton Farley Strickland, Jr.	Tabor City

General Studies

Degrees Conferred December 20, 1983

Earnest Christopher Butler	New Bern
James Ezra Ethridge	Louisburg
Ricardo Juan Portela	Roanoke Rapids

Degrees Conferred May 12, 1984

Randall George Benton	Greensboro
Phillip Roosevelt Bunn	Zebulon

Health Occupations Teacher Education

Degrees Conferred May 12, 1984

Frances Anderson Ballard	Halifax
***Debra Anne Hall	Aberdeen
***Gail Bradshaw Joyner	Roanoke Rapids
Jane Boone Lambert	Rockingham
**Ray Nell Pearsall	Fuquay-Varina
*Donald Kenneth Thomas	Sanford
***Susan Elaine Merkel Wilkerson	Cary

Industrial Arts Education

Degrees Conferred August 10, 1983

Kevin Michael Core	Raleigh
Robert Franklin Mathews	Warsaw
Mark Alan Roberts	Emmaus, PA

Degrees Conferred December 20, 1983

Robby Dale Cuthrell	Pantego
James Craig Hicks	Raleigh
William Albert Keith, III	Raleigh
Scott Woolard Kennedy	Raleigh
Gayle Elizabeth Murray	Fontana Dam
Bruce Hamilton Starr	Raleigh

Degrees Conferred May 12, 1984

Richard Carlton Day, Jr.	Raleigh
Leah Renee Dove	Burke, VA
Ralph William Evans	Hatteras
James Eugene Everett	Goldsboro
Michael Charles Hall	Raleigh
David Allen Knecht	Durham
*David Randolph Milton	Louisburg
Jan Brinn Moffett	Raleigh
Patrick Dewey Murphy	Roanoke Rapids
Daniel Wayne Osborne	Garner
Allen Rankin Smith	Mt. Holly
David Burnett Smith	Salinas, CA
*Joseph Christopher Terry	Charlotte

Mathematics Education

Degrees Conferred December 20, 1983

Heidi Karil Clayton	Cary
Dawn Elizabeth Collins	Raleigh
*Sharon Brown Frederick	Raleigh
Jimmy Gordan Ray	Bailey

Degrees Conferred May 12, 1984

Suzanne Andrews	Clemmons
*Orphia Louise Barnes	High Point
*Lenora Ittenbach Birdsell	Fayetteville
*Patricia Carole Castor	China Grove
Susan Annette Glenn	Hendersonville
**Judith Lynne Quick	Garner
Catherine Margaret Schwartz	Emerald Isle
Helen Osborne Sommerville	Raleigh

Science Education

Degrees Conferred December 20, 1983

Patrick Charles Knox	Raleigh
June Gail Braden Mascho	Fayetteville
**Gregory Thomas Morris	Wilson
Donna Rose Pope	Cedar Grove
Aloma Helms Small	China Grove
Eric Dwayne Smith	Graham
**Janet Laverne Pettigrew Wall	Garner

Degrees Conferred May 12, 1984

William Harry Charles	Spencer
**Brenda Lynn Dorman	Garner
John Charles Hall	Sanford
Gary Van Hunsucker	High Point
†Lisa Rachael Klimek	Gastonia
Lisa Pearl Lanier	Garner
Karen Flowers Porter	Garner
Dossie Alonza Poteat	Yanceyville
**Nancy Jacqueline Sheets	Raleigh
†Lorna Leigh Vaughan	Bon Air, VA

Social Studies Education

Degree Conferred December 20, 1983

*Jackie Sullivan Brown Selma

Degrees Conferred May 12, 1984

**Verleen Blackwill Jones Raleigh

Vocational Industrial Education

Degree Conferred December 20, 1983

Robin Lea Tatum Winston-Salem

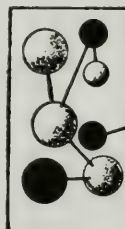
Degrees Conferred May 12, 1984

Robert Eugene Abraham Myrtle Beach, SC

Steve Lynn Myers Raleigh

Sheila San Wilkerson Raleigh

School of Engineering



BACHELOR OF SCIENCE IN BIOLOGICAL AND AGRICULTURAL ENGINEERING

Jointly administered by the School of Agriculture and Life Sciences and the School of Engineering.

Degree Conferred December 20, 1983

*Thomas Michael Pluer Cornelius

Degrees Conferred May 12, 1984

*Alicia Lee Lanier Clarkton

*Timothy James Lease Raleigh

Patricia Joy Parker Rocky Mount

Robert Gregory Swain Warsaw

BACHELOR OF SCIENCE IN AEROSPACE ENGINEERING

Degree Conferred June 29, 1983

Michael Edwin Kern Charlotte

Degrees Conferred August 10, 1983

Jonathan Ray Arndt Charlotte

Jane Clara Curtis Kinston

† Co-major

* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

Al Cederic Smith	Wake Forest
William Stanford Smith	Jacksonville, FL

Degrees Conferred December 20, 1983

**Foy McNeil Cheatwood	Winston-Salem
Jay Thatcher Gillam, II	Arden
Tuan Anh Hoang	Fayetteville
Colin Amond Holway	Charlotte
David Wilson Meadows, Jr.	Goldsboro
Carr Dee Nabers	Hillsborough
Raymond Joseph Warburton	Greenville
Roscoe Warren, Jr.	Statesville
Kenneth Bernard Workman	Raleigh

Degrees Conferred May 12, 1984

Michael Jeffrey Adkins	Cary
James Lee Ashworth	McAdenville
Samuel Lee Bates	Fluvanna County, VA
Roger Leon Bean	Laurinburg
Derrick Jerome Cheston	Norlina
*William Lee Cochran	Huntersville
Boris Brumit DeLaine	Charlotte
Richard Gordon Duncan	Charlotte
*Lester Anderson Foster, III	Dundalk, MD
Richard Lee Gaffney, Jr.	Fayetteville
Edrew Johnson, Jr.	Havelock
Marc David Johnson	Asheville
Stuart Darrell Johnson	Burlington
*Jeffrey Alan Kronenwetter	Raleigh
Jon Cochran Martin	Kannapolis
Michael Wayne May	Cary
***Robert Alan Mitcheltree	Charlotte
Eric David Ohlwiler	Goldenrod, FL
James Randall Penley	Asheville
John Charles Penney	West Palm Beach, FL
*Randall Leon Riddle	Mt. Airy
George Cass Ronan, IV	Rutherfordton
George Stewart Rutledge, Jr.	Raleigh
Sue Tillett Scruggs	Raleigh
**Monty Lee Shelton	Winston-Salem
Darren Tola	Rocky Mount
Tony Ray Tyler	Hallsboro
***Richard Alan Wahls	Raleigh
*Charles Franklin Walker, Jr.	Salisbury
Dennis James West	Erwin
Neil Franklin Williams	Elon College
Ronnie Eugene Wilson	Wilmington

BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING

Degrees Conferred June 29, 1983

John McDavitt Bassett	Raleigh
Jerry Anthony Coston	Rocky Point
Janet Lee Hart	Savannah, GA
Benjamin Harold Lanier	Snow Hill
Takeshi Monno	Osaka, Japan
Pierre Willy Simmen	Thomasville

Charles Curtis Vaught	Greensboro
Eric Stephen Ward	Charlotte

Degrees Conferred August 10, 1983

Carol Anne Bennett	Vestal, NY
Johnna Whitlock Embree	Fayetteville
Mark Howard Foshee	Wake Forest
Kevin Lee Lockerby	Forest City
†**Pinank Rajanikant Mehta	Ahmadabad, India
***Brooks James Story	Lenoir

Degrees Conferred December 20, 1983

George Gregory Bengé	Rural Hall
Kenneth Warren Blankenship	Havelock
Pamela Sue Borah	Louisville, KY
Michael Joseph Brown	Carthage
***Walter Thomas Calhoun	Greenville
Robert Spalding Craycroft	High Point
Charles Mann Davis	Concord
Phillip Reid Elkins	Goldston
*Brenda Leanna Eutsler	Havelock
Julia Lee Gibson	Raeford
Linda Frank Harris	Wendell
Todd Wayne Heavner	Belmont
***Dwayne Henry Hinkie	Silsbee, TX
Laura Mausá Hinson	Monroe
Stephen Howard Holt	Summit, NJ
*Joseph Donald Hosch	Pensacola, FL
Rhonda Jean Hunt	High Point
†Mark Garland Johnson	Durham
***Steven Edward Kirk	Pensacola, FL
Joyce Elizabeth Lackey	Pensacola, FL
John Herman Litschert, II	Philadelphia, PA
*Bryce Blakney Lowery, Jr.	Concord
Audie Bryan Mitcham	Granite Falls
***Charles Albert Moore	Charlotte
Daniel Michael Otto	Wilmington
Steven Herman Parker	Asheboro
Robert Kenneth Parsons, Jr.	Franklin
*James David Pegram	Henderson
Styron Narz Powers	Rose Hill
Marcus Ellis Rabil	Riverton, NJ
George Wilford Radford, Jr.	Eden
Cheryl Lee Reid	Fayetteville
*Barbara Ann Salerno	Lodi, NJ
*Pamela Hamilton Saunders	Raleigh
*Laura Anne Seely	Pensacola, FL
Ernie Robert Silva	Brevard
Thomas Edward Single	Doraville, GA
Linda Stellmann	Lodi, NJ
*Donna Teresa Brewer Stewart	Raleigh
*Eric Stuart Sylvester	Mobile, AL
Brian Douglas Tiffany	Raleigh
Donna Carol Tucker	Charlotte
Sherri Anne Vaden	Danbury
Gary Tab Vestal	Winston-Salem
James Frank Wallwork, Jr.	Kernersville
**Brian David Ward	Greensboro

† Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

Doris Ann Witmore	Matthews
Gregory Alan Young	Raleigh

Degrees Conferred May 12, 1984

Donald James Arthur	Fayetteville
†***James Williams Bales	New London
**David Stephen Ballance	Albany, NY
Thomas Calvin Basnight	Plymouth
†Tammie Sue Bernard	Oxford
Russell Stuart Berry	Raleigh
Gary Martin Birk	Greensboro
*Matthew John Bothe	Big Flats, NY
Claude Weddle Burgess	Buies Creek
Theodore Lamont Bush, Jr.	Salisbury
*Kevin Mathew Byers	Riegelwood
**Mary Ann Byrd	Raleigh
Spero William Calos, Jr.	Charlotte
***Jeffrey Paul Campbell	Kings Mountain
*Michael Charles Clapp	Fayetteville
**Steven Charles Davies	Charlotte
Antonio Vincent Evans	Morganton
Clifton Ray Game	New Bern
***Jeffrey Ray Garwood	Kingsport, TN
**Amy Margot Gitelman	Chapel Hill
***Frederick Harrison Gregory, Jr.	Havre de Grace, MD
Mark Alan Guyer	Baltimore, MD
Michael Derek Hardy	Raleigh
***Brogdon Guy Harris, II	Raleigh
Richard Lance Hilton	Fayetteville
Carleen Yetta Houston	Hampton, VA
†Jeffrey Neal Johnson	McLeansville
Larry Niles Johnson, Jr.	Hillsborough
†Brenda Leigh Kelly	Garner
***Jennifer Thompson Kelvington	Raleigh
Theresa Lynn Kimrey	Ramseur
Penny Elizabeth Lassiter	Raleigh
Daphne Ella Lee	Norwood
Scott Frederick Lett	Waxhaw
Thomas Woodson Markham	Richmond, VA
*Gary Edward Marler	Jacksonville
Laurel Lee McCollum	Greensboro
Bonnie Gail McCoy	Raleigh
†Daniel Frederick McCulloch, Jr.	Hartsville, SC
Jeffrey Lawrence McManus	Wilmington
†**Gregory Alan Mills	Oakboro
Ronald Bruce Moser	Wallburg
*Chris Steven Nicoletti	Cary
John Lester Parkinson	Fayetteville
John Allen Phillips, Jr.	Durham
Rita Kumari Prasad	Raleigh
**Tracy Allison Proctor	Sanford
*Darren Scott Quinn	Goldsboro
*Ralph Setser Ramsey	Franklin
Peter Michael Richards	Bethesda, MD
Marshall Wainwright Ritchie	Concord
Donovan Katakura Rocha	Fayetteville
Donald Lee Safrit	Salisbury

† Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

Surya Narayan Satapathy	Burlington
*Patrick Francis Schell	Charlotte
†John Shepley Schofield, IV	Charlotte
Teresa Lynn Schurter	Garner
Donna Lynn Scott	Reidsville
Steven Paul Smith	Stanley
Candace Belinda Sorrell	Durham
Sharon Handy Srebro	North Wilkesboro
**John Harold Talton, Jr.	New Bern
Jerry Grandon Tew, Jr.	Durham
Wiley Eugene Tuttle	Walnut Cove
**Harlan Roy Wilk	Raleigh
Jonathan David Williams	High Point
Tony Wong	Greensboro
**Mary Kathleen Owen Woodard	Boone
**Christi Sue Wyant	Brevard
***Mark Anderson Young	Raleigh

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

Degrees Conferred June 29, 1983

Cheryl Denise Agner	Salisbury
Laura Michelle Holloway	Cary
Craig Stuart Keller	Middletown, NJ
*Samuel Alex Levin	Charlotte
George Patterson Martin	Mt. Airy
**Robert Bernard Rhodes	Wilson
Stanley Byron Traynham	Morganton

Degrees Conferred August 10, 1983

**David Jeffrey Bowlin	Lenoir
Anna Michelle Callanan	Hickory
Bart Alan Duke	Wendell
Deana Mahmoud Fakhoury	Raleigh
Charles Robert Lawrence	Asheville
Kiritkumar Damodardas Padia	Gujarat, India
Richard Paul Underwood	Goldsboro
Warren Franklin Walker	Fayetteville

Degrees Conferred December 20, 1983

*Ronald Jean Aboutaan	Zahle, Lebanon
Joseph Clayton Avolis	Washington
David Alan Bailey	Raleigh
*Timothy Harold Barbour	Benson
James Alton Bissett, Jr.	Henderson
Gary Scott Boyles	Shelby
Douglas Ray Calhoun	Garner
Reuben Dwayne Chandler	Lenoir
David Keel Conrad	Etters, PA
Victor Irwin Czar	Rocky Mount
Gregory Arlan Dean	Cary
Charles Lee Flowe	Raleigh
David Shane Franks	Elizabeth City
*William Thomas Fuller	Chapel Hill
*George Alexander Garey, III	Greensboro
Francis Joseph Gioscio, Jr.	Boone
David Brian Hoff	Charlotte
Thomas Woodard Jones	Charlotte

† Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

*Ronald Lee Knott	Scotland Neck
Mark Theron Ledford	Clyde
Alan Street Lee	Robersonville
Mark Alan Leonard	Fayetteville
Carolyn Diane McCaskill	Vass
James Stephen McKee	Charlotte
Richard Lee Modlin	Chapel Hill
Edward Grey Murray	Roanoke Rapids
Eric Edward Olsen	Raleigh
Rebecca Joanne Page	Yanceyville
Jan Carol Pass	Clemmons
Jackson Ward Provost, Jr.	Swansboro
William Howard Pruden, III	Roanoke Rapids
†***Anthony William Reevey	Durham
Michael Stroupe Robinson	Gastonia
Linda Anne Stacy	Berwyn, PA
Sandra Atkins Stepney	Greenville
Roy Joseph Surgi, Jr.	Hickory
James Jackson Swain, Jr.	Asheville
Wiley Christopher Thompson	Goldsboro
Erwin Thompson Williams, III	Lumberton
**Michael Anthony Young	Lexington
Thomas Peter Ziegler	Asheboro

Degrees Conferred May 12, 1984

Khaled Ali Al-Akhdar	Sidon, Lebanon
Khaled Mustafa Al-Hasan	Jericho, Jordan
Charles Gregory Bagley	Williamston
David Holden Blevins	Winston-Salem
Tina Suzanne Brittain	Newton
Stephen Carl Browde	Raleigh
Christopher Howard Brown	Raleigh
*Charles Michael Bullard	Sophia
Glenn Carlos Cameron	Raleigh
Verne Ellis Cayton, Jr.	Jacksonville
Daniel Robert Chapoton	Morehead City
Leonard Mark Collins	Newport
James Ralph Compton	Burlington
Tracey Lynn Conrad	Winston-Salem
Stephen Darryl Cook	Hertford
Kerry Travis Cross	Garner
Ronald Maurice Frink	Chadbourn
Jonathan Andrew Gay	Jacksonville
*George Grady Harper	Garner
*Joseph Edward Harrison, Jr.	Raleigh
Kelly Eugene Hayes	Lexington
*Joe Barrett Hennings	East Bend
***William Greene Hollowell	Richmond, VA
Jeffrey Scott Howard	Winston-Salem
Chad Howard Huggins	Schenectady, NY
Kenneth Larrimore Johnson, Jr.	Cary
George Minas Karageorge	Clearwater, FL
Patrick Alexander Keane	Randolph, NJ
James Vanty Lamb, II	Lumberton
Michael Paul Lester	Raleigh
Alison Faye Lewis	Shallotte

***Wesley Martin Lowder	Albemarle
***Robert John Martin	Raleigh
***Ralph Andrew Mills	Lexington
Kenneth William Moody	White Plains, VA
Kenneth Scott Murchison	Lillington
Edward Glenn Newsome	Selma
Muhammad Awad Odeh	Nablus, Jordan
Vasilios Costantine Parathiras	Athens, Greece
Herbert Allen Pope	Belhaven
Warner Cooper Rackley	Farmville
Johnny Houston Ross	Monroe
Michael Gary Schiller	Mitchellville, MD
**Barry Dwain Shearin	Louisburg
Christopher Mark Shoaf	Salisbury
Frederick Ross Stroud	Kinston
James Edward Struffolino	Cary
***Pamela Knapp Townsend	Raleigh
Charles Paul Truby, Jr.	Towaco, NJ
Jones Clement Vick, Jr.	Tarboro
Jay Scott Westbrook	Taylorsville
William Jeffrey White	Alexandria, VA
**Billy Merle Williams, Jr.	Williamston
**Steve Lewis Wilson	Garner
***Joseph Allen Wolhar	Charlotte

BACHELOR OF SCIENCE IN CIVIL ENGINEERING— CONSTRUCTION OPTION

Degrees Conferred June 29, 1983

James Charles Ernst	Roxboro
Richard Todd Pierry	Point Pleasant, NJ

Degrees Conferred August 10, 1983

James Horton Doughton	Raleigh
Gregory Joseph Selzer	Charlotte

Degrees Conferred December 20, 1983

**Harold James Barnhardt	Burlington
Jonathan Jay Blitz	Bethesda, MD
James Harvey Dobbins	Greenville
James Alexander Gaither	Monroe
Edgar Clyde Garber, III	Fayetteville
David Alan Greene	Cary
***Mark Lindley Haskett	Union, MI
David Duane Horne	Graham
Lisa Michele Jenkins	Raleigh
Thomas Allen Key	Elkin
Kimberly Lynn Lineberger	Gastonia
Gregory Allan Lusk	Swansboro
David Allen Masterson	Brevard
Thomas Russell Overton	Canton
Lisa Kay Smith	Freeport, IL
Michael Gene Wilson	Hickory

Degrees Conferred May 12, 1984

Terry Glenn Alexander	Winston-Salem
Fawzi Hesham Arafat	Nablus, Jordan
**Wael Suleiman Arafat	Nablus, Jordan
Clifton Mark Averette	Clemmons
*Samer Salah Beidas	Beirut, Lebanon
James Emory Blackwell	Davidson
*Stephen Robert Blanton	Raleigh
Richard Clarence Brake, IV	Kitty Hawk
Vernon Bernard Crudup	Nashville
James Clark Eatmon	Wilson
*David John Eberspaker	Sanford
***George Leon Eller	High Point
Scott Lassiter Emory	Rich Square
Paul Timothy Fordham	Raleigh
Kyle Alexander Harrell	Asheville
Michael Lynn Holder	Greensboro
Christopher Ashley Holmes	Wilmington
Mark Richard Hyder	Pittsburgh, PA
Joseph Neil Jarrell	Salisbury
Drew Millard Johnson	Garner
Fred Douglas Johnson	Fremont
James Dinwiddie Kilgore, II	Raleigh
Richard John Lemere	Acton, MA
Lester Vincent Lowe, III	Wilson
Michael Erie Mitchell	Goldsboro
Diana Ruth Mukamal	Whiteville
Charles Allen Newsome	Raleigh
Roger Lee Perose, III	Allentown, PA
Vincent Stanley Tryer, Jr.	Wilmington
Anthony Leewai Voo	Flossmoor, IL
Richard Hall Ward	Raleigh
Julie Renee Wilkins	Laurinburg
**Richard Julian Wyche	Henderson
***James Barnes Wyngaarden, Jr.	Durham

BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING

Degrees Conferred June 29, 1983

Michael Jude Carroll	Milwaukee, WI
James Kirk McBee, Jr.	Newton
Jae Hwan Nam	Fayetteville
Eugene Barron Phillips, II	Raleigh
Clinton Ellis Piland	Fayetteville
Lorgio Rodas-Milosevich	Santa Cruz, Bolivia
Paul Allan Sadoski	Cary
Michael Delaney Tabron	Littleton
**David Shawn Trotter	Lewisville

Degrees Conferred August 10, 1983

Oscar Frank Everitte, Jr.	Parkton
Greta Habib	Alexandria, VA
Kevin Dale Jones	Wendell
David John Novicki	Winston-Salem

William Jennings Roberts, Jr.	Roseboro
Forest Wilkinson Rogers, Jr.	Gastonia
Roy Bruce Strayhorn, Jr.	Durham

Degrees Conferred December 20, 1983

*Richard Forrest Ambrose	Fayetteville
Alan Clark Bailey	Lexington
***Leslie Kile Blair	Cary
Chris Anthony Bowman	Winston-Salem
Joseph Bradford Brannon	Greensboro
Charles Maxwell Burns	Raleigh
Robert Thomas Burton	Charlotte
Eugene Phillip Carroll	Cherryville
Stephen Richard Cranfill	Reidsville
Raymond Lindsey Davis	Durham
Jeffrey Joel Dobbins	Raleigh
***Garland Michael Edwards	Eden
Kenneth Michael Edwards	Norwood
Timothy Richard Emery	Greensboro
Nathan Ross Fritts	Thomasville
**William Richard Grey, IV	Asheboro
Barry James Hensley	Dayton, OH
Patricia Ann Holden	Raleigh
Jimmie David Holmes	Clayton
Christopher Lewis Huff	Kernersville
Barry Steven Jones	Burlington
David Lee Joyce	High Point
Eric Wilson Justice	Charlotte
Brian Dale Klappenbach	Raleigh
Thomas Edward La Barbera	Washington
Susan Ann Langley	Conover
Edmund Gorham Lansche	New Bern
Wayne Neal Lewis	Greenville
James Ray Manning	Henderson
Terri Lee Marshbourne	Castalia
**Daniel William McFerrin	Newton
Linwood Brent McLeod	Clayton
Bruce Davis McTigue	Montreat
*Timothy Philip Moore	Sanford
**Christopher Carl Morhard	Elizabeth City
Keith Weidler Neunzig	Raleigh
Elliott Hill Newcombe, III	Charlotte
Huy Xuan Nguyen	Raleigh
Michael Low Patterson	Cary
George Herman Price, Jr.	Windsor
Barry Wayne Propst	Newton
Colon Lee Saunders	Morganton
Edwin Goddard Scott	Franklin
Ziya Senyuva	Adana, Turkey
Bryan Frederick Sickels	Greenville
Robert Allen Sipes	Statesville
William Benton Strickland	Spring Hope
Chandra Maulishwar Thakur	Raleigh
Gary Allen Thrower	Greensboro
Thomas Earl Tice	Monroe
Robert Ernest Troxler	Raleigh
John William Van Strien	Fayetteville
Claude Louis Vignali	Raleigh

† Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

Mark Richardson Vinson	Raleigh
David Evan Webb	Oceanside, CA
John Stewart Wetherington	New Bern
Curtis Blaney Williams	Dunn

Degrees Conferred May 12, 1984

Russell Alan Adams	Gastonia
Hassan Rachid Alawar	Kornayel, Lebanon
***John Michael Amein	Raleigh
***Lance Lee Arnder	Goldsboro
William Lee Barfield	Durham
Larry Dean Barnes	Greensboro
Donna Faye Barrett	Reidsville
David Wayne Bateman	Raleigh
Harry Webb Baylor	Norfolk, VA
Edward Forrest Beacham, Jr.	Wilmington
Thomas Lynn Beam	Mooresville
Edward Alan Bolick	Hickory
Wendy Caroline Bothwell	Raleigh
†Dennis Edward Brady	Fayetteville
Christopher Owen Bransford	Greensboro
Mark Livingston Bridger	Bladenboro
Mark Andrew Burton	Greensboro
Raymond James Chappell	Hobbsville
John Andrew Chiu	Charlotte
**Edward Randolph Collins, Jr.	Rockingham
*Lawrence William Cook	Oakton, VA
***Wesley Blair Covell	Boone
Russell Dixon Cronquist	Chapel Hill
Elizabeth Ann Davis	Kinston
Douglas Robert Deming	Columbia, MO
William Clarence Donaldson	Raleigh
Carl Wesley Douglas	Wendell
Douglas Joe Edwards	Spring Hope
Robert Porter Edwards	Dobson
Ernest Eugene Flowers	Aurora
***Bruce Todd Freedman	Raleigh
David Clark Goodman	Winston-Salem
Dorothy Almeta Gray	Raleigh
Frederick Martin Grimm	Carthage
*David Bruce Guild	Durham
Douglas David Hall	Eden
Mark Joel Harris	Cherry Hill, NJ
Carol Annette Hedberg	Charlotte
Raymond Joseph Hilgart	Fayetteville
Douglas Randall Hilliard	Apex
Chung-Sing Ho	Hong Kong, China
Charles Jeffrey Hoots	Flat Rock
Charles Edward Jamison, Jr.	Cary
David Wayne Johnson	Cary
Mark Douglas Johnson	Cary
*Richard Lewis Johnson, Jr.	Charlotte

Behnam Katibian	Holon, Israel
*Keith Kind	Merrick, NY
***Richard Benjamin Knapp	Morgantown, WV
**Clifford Henry Knoll	Greensboro
Lily Koura	Raleigh
***Mark Joel Lanzo	Durham
Jooran Lee	Winston-Salem
*William Bartholomew Lineback	Clayton
Eugene Gray Lockhart, Jr.	Morehead City
Louis Kenneth Lospinuso	Durham
Walter Anthony McCoy	Goldsboro
Edward Grafton McGavran, III	Concord
***Foil William McLaughlin, Jr.	Raleigh
Martin Dean Meyer	Raleigh
Jeffery Ray Moser	Dobson
***Liem Hong Nguyen	Raleigh
†Robert Alton O'Neal	Eden
Steven Ralph Parham	Greensboro
†**George Keith Parish	Raleigh
Keith Glen Pehl	Charlotte
Stuart Allen Peoples	Kinston
William Eric Peterson	Hickory
Clifton Douglas Petteway	Greensboro
Bobby Gia Pham	Fayetteville
Jeffrey Craig Phipps	Turkey
Joseph Dana Ragland	Oxford
**Rajesh Rao	Raleigh
Joann Rivenbark	Rose Hill
Clarence Vernon Roberts	Salisbury
Lesley Thomas Robinson	Oriental
Lester Daniel Robinson	Moorestville
Roberto Salama	Cochabamba, Bolivia
Mark Elmer Seawell	Carthage
***Brandon Mark Sherrill	Statesville
Thomas Mark Shore	Jonesville
Susan Mary Sierer	Ironton, OH
David Bingham Stinson	Durham
Edwin Douglas Terres, Jr.	Dallas
**David Anthony Thomas	Charlotte
Evangelos Tzathas	Athens, Greece
Leslie Michelle VanLandingham	Fayetteville
John Louis Ventriglia	Raleigh
**Eugene Carl West, Jr.	Bunnlevel
Ronnie Steven Whisenant	Morganton
Steven Rowland Widener	Winston-Salem
Linda Jean Woodward	Richfield, OH
Frank Burkhead Wyatt, II	High Point
Craig Stevens Wyrick	Richlands

BACHELOR OF SCIENCE IN ENGINEERING OPERATIONS

Degrees Conferred June 29, 1983

Lee Nathaniel Davis	Asheville
David Crawford Howell	Charlotte

† Co-major

* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

Dabney Ragland Maides	Fayetteville
Bud Mitchell Owens	Mt. Airy
Susan Lynn Sexton	Raleigh

Degrees Conferred August 10, 1983

Michael Levi Johnson	Sanford
Kimberly Michelle Schofield	Titusville, FL
John Taylor Seymour	Raleigh
Ray Lloyd Warrick	Raleigh
Ronald Wade Williams	Somerset, NJ

Degrees Conferred December 20, 1983

*George Shafer Barringer, Jr.	Salisbury
Stanford Eugene Benson	Raleigh
Kenneth Russell Brown	Mt. Airy
Alison Jill Brownstein	Greensboro
David Charles Cain	Clemmons
Jeffery Leroy Collins	Mt. Airy
Robin Van Comer	Goldsboro
*William Gerald Douglas	Georgetown, SC
Kenneth Lee Edwards	Archdale
Carl Maukert Holler	Durham
Bobby Christopher Edward Keyes	Greenville
Joseph Carl Kinney	Bowie, MD
Carey Anne McGinnity McCrackan	Raleigh
Cathy Lee Nance	Randleman
James George Nutsch, II	Greensboro
*James Robert Pendergrass	Faith
Allyson Wendela Reed	Charlotte
*James Clinton Wolfe	Raleigh

Degrees Conferred May 12, 1984

Michael Glenn Arndt	Hickory
Chattie Beatrice Broadnax	Eden
*Almon Hill Carter, III	Wallace
Constantine Lewis Chininis	Greensboro
Eric Jerome Clark	Baltimore, MD
Don Phillip Duncan, Jr.	Salisbury
William Bernard Graves	Raleigh
Suzanne Carol Hampton	Winston-Salem
Jeffrey Antonio Hill	Durham
***Benny Daryl Holbrook	Thurmond
Hal Mark Howard	Jacksonville
Roland Jackson Howard, Jr.	Hampstead
†Christopher Dale La Brie	Leland
David Allen Lane	Charlotte
David Keith Mauney	Shelby
Jennifer Ann Quick	Cary
Kevin Curtis Scotton	Eden
Larry Duane Sloan	Winston-Salem
Margaret Catherine Tennent	Salisbury
Robin Renee Tolbert	Greensboro
Thomas Grey Wagoner	Reidsville
Wendell Wesley Wall	Madison
Raymond Mark Walton	Wilmington

† Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

Susan White West	Sanford
Barry Grant Williams	Greensboro

BACHELOR OF SCIENCE IN FURNITURE MANUFACTURING AND MANAGEMENT

Degrees Conferred June 29, 1983

Joe Ray Hawkins	Colfax
Michael Alan Schneiderman	Greensboro

Degree Conferred August 10, 1983

Joseph Franklin Slater	Lewisville
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Degrees Conferred December 20, 1983

Sandra Leigh Broyhill	Taylorsville
Laura Ann Crotts	Winston-Salem
Linda Darlene Holbert	Hendersonville
Sheila Dawn Poe Isbell	Raleigh
Larry Dean Lyerly	Dallas
Jesse Marvin Paschall, III	Morganton
***Winthrop Schwab, Jr.	Raleigh
William Edward Smith	Newton

Degrees Conferred May 12, 1984

William Kelly Barlow	Lenoir
James Robert Buchanan	Conover
*William Alexander Deaton, Jr.	Charlotte
David Russell Epperson	Raleigh
David Ephlin Gillespie, Jr.	Raleigh
Jack Fleet Lewis, Jr.	High Point
**David Lawrence Pollpeter	Normal, IL
David Wayne Shore	Rural Hall
Nathan Edwin Smith	Lincolnton
George Key Snow, III	Hickory
Kevin Jay Ward	Lexington
Jimmy Tat-Ming Yeung	Hong Kong, China
Mark Derrick Young	Lexington

BACHELOR OF SCIENCE IN INDUSTRIAL ENGINEERING

Degrees Conferred June 29, 1983

Robert Mercer Burger, Jr.	Durham
Joseph Kevin Mack	Mooreville
Kenneth Howard Vereen	Durham
Richard Yang	Taipei, Taiwan

Degrees Conferred August 10, 1983

Peter Marshall Cabaniss	Shelby
William Russell Gerald	Tabor City
Mark Eugene Helms	Asheville

Degrees Conferred December 20, 1983

Ferdağ Bülent Acar	Istanbul, Turkey
Lenny Cooper Anderson	Edgefield, SC
Eric Severson Ashbaugh	Durham
Dale Robert Barbee	Durham

Jeanne LaRae Bingham	Advance
Robert Kevin Bowers	Graham
Sharon Beth Campbell	Biloxi, MS
Mark Collier Caudill	Goldsboro
Mitchell Barry Cooperman	Virginia Beach, VA
Jo Lindy Kaye Daniels	Greenville
Lisa Michelle Davis	Hickory
Kelly Louise Dula	Lenoir
Marcia Molesky Felton	Wilson
Tyrone Barry Gahagan	Raleigh
Mary Ellen Hall	Snow Hill
Harold Dean Hawkins	Greensboro
Jeffrey Daniel Hedges	Fayetteville
Robert Kevin Jackson	Fayetteville
*** Anne Shaw Lawrence	Dobbs Ferry, NY
Paul Hughes Moorefield	Raleigh
Barry Edward Noonan	Haddon Heights, NJ
Roscoe Franklin Parker	Micro
Haleh Shammasifahani	Tehran, Iran
Dean Massey Stewart	Charlotte
James Earl Turnage	Snow Hill
Karen Ann Welker	Greensboro

Degrees Conferred May 12, 1984

Carla Ana Amrhein	Sparta
Louella Anderson	Durham
Christopher Michael Atkins	Dallas
*** Linda Van't Wout Birch	Raleigh
Jeff Scott Bolick	Hickory
Glenwood Jackson Boykin, Jr.	Roanoke Rapids
* Erica Sharleen Brown	Winston-Salem
Dennis Ray Bunn	Goldsboro
Michael Lee Burge	Greensboro
Rosa Lyn Chrismon	Asheboro
Sarah Elizabeth Clarke	Hickory
Kathy Sakiewicz Cody	Raleigh
Michael Andrew Cramer	Rose Valley, PA
* Marsha Gail Culver	Salisbury, MD
Martino Watson Dennis	Winston-Salem
George Bennie Dixon, Jr.	Havelock
* Susan Lee Douglass	Lutherville, MD
* Steven Michael Elderkin	Raleigh
Henry Todd Garrou	Valdese
Russell Thomas Goldner	Lincolnton
Jorutha Katrina Griffin	Kannapolis
Brenda Sue Hartsfield	Raleigh
Barbara Elaine Hollerung	Fayetteville
Charles Alan Horne	Rocky Mount
Mark Andrew Hovis	Stanley
William Clegg Howard, Jr.	Winston-Salem
Leonard Wallace Jones	Rio Piedras, Puerto Rico
Randy Craig Kirkman	Liberty
* Patricia Joe Laughter	Hendersonville

Kathy Jo Lee	Burlington
Kenneth Dwight Lee	Fayetteville
Jeff Michael Malcolm	Raleigh
Rebecca Joyce Marsh	Sanford
Ann Elizabeth McGuinn	Fairview
Charles Michael McIver	Sanford
**James Sugg McLawhorn	Snow Hill
Warren Lexie Meadows	New Bern
Linda Ann Miller	Jamestown
Loretta Agnes Moeslein	Charlotte
Lola Denise Morgan	Angier
Quynh Hoa Thi Nguyen	Cary
Jearl Edward Noblett, Jr.	Gastonia
**Shirley Mehre Norris	Fayetteville
Louis Pikula, III	Winston-Salem
Lu Ann Riffe	Garner
James Eric Robinson	Winston-Salem
James Mitchell Rushing	Greenville, SC
Martha Mitchell Selover	New Bern
*Maria Michelle Sessoms	Sanford
Jeffrey Russell Setser	Winston-Salem
Leslie Bryant Smith	Greensboro
**Sally Elizabeth Smith	Raleigh
Elizabeth Walker McKinney Sullivan	Raleigh
Deborah Leah Swarts	Holden Beach
Scott Randall Tosto	Madison
Ana Lourdes Vasquez	La Ceiba, Honduras
Ricky Kim Wallin	Marshall
David Bryan Wessinger	Asheboro
***David Erwin Whiteman	Raleigh
*Waring Lewis Worsham, Jr.	Canton

BACHELOR OF SCIENCE IN MATERIALS ENGINEERING

Degrees Conferred June 29, 1983

John Allen Bateman	Burlington
Alan Wade Maddox	Durham
William Mark Sanders	Kings Mountain

Degrees Conferred August 10, 1983

Steven Paul Green	Fayetteville
†Glenn Wade Leach, Jr.	High Point

Degrees Conferred December 20, 1983

William John Crann, Jr.	Charlotte
Kevin Frank Guyton	Raleigh
Henry Bland Hutton	Burlington
Leodis Jennings	High Point
Penny Wootton Powell	Jacksonville
Michael Wayne Shelton	Jamestown
Robert Allen Worley	Crumpler

Degrees Conferred May 12, 1984

**Terry Lynn Alford	Fayetteville
Alison Joyce Bailey	Derwood, MD

Georgia Anne Canon	Albemarle
**Robert Charles Deak	Raleigh
David Wayne Gandy	Concord
Jimmy Lee Green	Jacksonville
Darryl Maurice Greene	Forest City
Lisa Joanne Hager	Denver
Gary Lee Jarvis	Fletcher
Gregory Mark Jeffers	Raleigh
Jeffrey Robert LeBold	Charlotte
***Laura Elizabeth Papa	Painted Post, NY
Jeffrey Charles Renz	Pittsburgh, PA
Ronald Christopher Roux	Greensboro
David Carl Seib	Raleigh
Grant Hooper Service	Durham
Lisa Kirkpatrick Swan	Rockingham
Marshall Troutman Sykes	Pinebluff
Lacy Williams, III	Fayetteville
Keith Danford Wilson	Gastonia

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

Degrees Conferred June 29, 1983

James Grant Andrews, Jr.	Winston-Salem
**David Allan Blasbalg	Raleigh
Mark Francis DeStefano	Webster, NY
Douglas Max Howell	Norwood
Kevin Noel McCraw	Hendersonville
Roger Neil Saunders	Rockwell
*Benjamin Beal Shouse	King

Degrees Conferred August 10, 1983

John Robert Coble	Greensboro
Jane Louise Hombordy	Ventura, CA
†Glenn Wade Leach, Jr.	High Point
John Ivory Martin, Jr.	Charlotte
Frank Thomas Poerio, Jr.	Glenshaw, PA
*Mohammad Ali Sarrafian	Abadan, Iran
Susan Avery Sutton	Lenoir

Degrees Conferred December 20, 1983

Claude DeWitt Altman	Raleigh
Bradley Fred Averette	Knightdale
Randall Lynn Ballenger	Raleigh
James Edward Brown	Asheville
Thomas Bryan Brunner	Fayetteville
**George Haston Bumgardner, IV	Raleigh
Michael Harrison Burriss	Charlotte
Douglas Alan Campbell	New Bern
***Wilton Louis Cox, Jr.	Stantonsburg
Timothy Gray Crater	Winston-Salem
Michael LeRoy Dare	Southern Pines
Jeffrey Lynn Davis	Fairmont
Thomas D'Eufemia	Poughkeepsie, NY
*Stephen Keith Dorsett	Siler City
Michael Lee Edmond	Rocky Mount
Hossein Eshraghi	Ghom, Iran
Jay Donald Etheridge	Goldsboro

John Edward Evans	Morganton
***Alec Parker Flowers, Jr.	Wilson
Timothy Wayne Floyd	Chapel Hill
William Elwood Furr, Jr.	High Point
*Tanya Howard Gold	Asheboro
Larry Bailey Grice	Raleigh
Donnie Ray Griffin	Rocky Mount
Charles Emmett Gulledege, III	Hamlet
*Stanley Blanks Hankins	Greensboro
Charles Franklin Helms, Jr.	Monroe
David Philip Herbert	Asheville
Kenneth Leroy Heybrock	Greensboro
**Murl Travis Hill	Jasper, AL
Timothy Fields Holland	Randleman
Andrej Horvat	Gastonia
Fred Russell Humphries	Raleigh
Gregory Thomas Jarrett	Conover
Jack Daniel Johnson	Raleigh
James Lee Johnson	Matthews
Frank Wayne Jones	Bath
James Darrell Kidd	Mt. Airy
Nelson Vance Long	Tarboro
Sidney Edward Lowe	Moyock
Clifton Arnold Lynch, Jr.	Morehead City
Floyd Jeffrey Mangum	Charlotte
Walter Bly Mann	Oxford
*Frank Collier McCall	Statesville
Mark Steven McLemore	Greensboro
**William James McMahan	Durham
Diane Cheryl Mees	Wilmington
Tammy Lynn Moore	Greenville
**George McDonald Moorefield, II	Lexington
Mehran Nazemi	Tehran, Iran
Michael Joseph O'Melia	Smithfield
Ronald Gray Osborne, Jr.	Pleasant Garden
Ronnie Lee Overton	Greensboro
*Vijaykumar Dahya Patel	Kinston
†Mark Benjamin Patterson	Dobson
William Edward Piske, Jr.	Raleigh
Gus George Poulos	Asheville
Benjamin Neil Powers	Columbia, SC
Elizabeth Anne Reid	Matthews
Michael Scott Ritch	Liberty
*Billy Ray Rowe, Jr.	Holly Ridge
Thomas Richard Sampair	Raleigh
Frederick Line Seaman	Chapel Hill
Douglas Lee Setzer	Gastonia
Benjamin Augustus Sims	Hendersonville
**Philip Arnet Smart	Hickory
Keith Mitchell Spring	Durham
Joseph Dixon Thorndyke	Lumberton
***Eric John Torgerson	Raleigh
Charles William Touchstone	Greensboro
Scott Andrew Trierwiler	Wilmington
Benny Lofton Triplett	Greensboro
Agatha Lucy Tucker	Raleigh
Michael Brian Van Metre	Cary
*Frank Teague Wagner, Jr.	Raleigh
Moosa Zand	Tehran, Iran

† Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

Degrees Conferred May 12, 1984

Mohamad Elsayed Afify	Raleigh
William Lewis Anderson	South Boston, VA
Howard Gary Andrews	Goldsboro
Darrell Alan Baber	Durham
Robert Edward Banker	Gastonia
Douglas Sheridan Barbour	Charlotte
Michael Ray Barnes	Raleigh
David Gray Barnhardt	Advance
*Jay Franklin Barrington, Jr.	New Bern
David Edward Bass	Raleigh
James Robert Bond	Winston-Salem
Larry Marcus Brandon	Lewisville
Michael Ray Broadhead	Goldsboro
Larry Len Brock	Biscoe
**Jeffrey Richard Brooks	Laurinburg
Christopher Baldwin Buck	Alexandria, VA
***Christopher Mark Cagle	Rockingham
Robert Alvin Calhoun	Clayton
**David William Camacho, Jr.	Agana Heights, Guam
Steven Miles Carey	Burnsville
Kenneth Ray Carpenter	Raleigh
*Mark Swain Caviness	Siler City
***Daniel Snow Coffey	Raleigh
Robert Charles Corbin	Raleigh
William David Crahen	Clemmons
Edgar Felton Davis, II	Kernersville
Frederick Bryant Dicks	Denver
Michael Craig Dillard	Vienna, VA
Thomas Philip DiNardo	Jamesville
Charles Stephen Dixon	Elm City
William Jewell Dudley	Cedartown, GA
**Teri Ann Ecklund	Charlotte
*Ellen Marie Eldreth	West Jefferson
David Allen Ernest	Advance
***Richard Michael Farkas	Beaver, PA
Jeffrey Alvin Farringer	Laurinburg
*Keith Carnel Felton	Elizabeth City
*Lewis Bailey Forrest	Morganton
Robert Moyer Fuller, Jr.	Wilmington
**Walter Stanley Gallagher, Jr.	Jacksonville, FL
John Weldon Gammon	Reidsville
Andrew Blair Garnier	Eden
John Porter Gerace	Sidney, NY
James Dale Gerber	Barnardsville
Beth Ann Giljames	Winston-Salem
James Simpson Glasscock, Jr.	Charlotte
*Philip Conrad Graves	Hickory
Michael Edward Hajnos	Charlotte
Marshall Brian Hampton	Charlotte
Diane Hatton	Wilkesboro
Christopher Clarence Hensley	Barnardsville
Ralph Michael Herran	Charlotte
Michael Thomas Hill	Kinston
Junius B. Hipp, Jr.	Denver
Andrew Paul Hitchcock	Charlotte
Benny Wayne Hockaday	Raleigh

† Co-major

* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

*Shepard Lynn Hockaday	Four Oaks
Charles Curtis Hodges	Charlotte
***Emory Everett Hodges	Eden
Curtis Grant Holland	Raleigh
Teresa Gay Holmes	Elizabeth City
Dale Sinclair Hopkins	Gastonia
William Paul Horne	Bellevue, WA
John Ward Howard	Pittsboro
Barry Simeon Howell	Stone Mountain, GA
William Lindsley Humbert	Winston-Salem
Fred Neal Hunter	Boone
Natalie Ann Huryn	New Bern
*Bruce Jerome Ingle	Conover
*Fariba Jabbarzadegan-Sorkhabi	Tehran, Iran
**Walter Wayne Jackson	Flat Rock
Donald Clayton Jones, Jr.	Raleigh
Eugene Marion Jones, Jr.	Tryon
**Kevin Scott Jones	Southport
Richard John Kilpatrick	Raleigh
David Welfred Kindley	Thomasville
Brian Edward Kintner	Black Mountain
Randall Everette Kiser	King
*Mark Stephan Landy	Charlotte
Stephen Ray Larsen	Raleigh
Robert Ben Lease	Raleigh
Eric Gregory Lee	Charlotte
Barry Mark Lineberger	Dallas
Tracy Ann Litaker	Hickory
Kevin Arthur Lively	Sylva
*Elmer Brentley Lutz	Newton
**Sherry Sanders Mabe	Denver
James Faucette Mallard	Kinston
Todd Holt Manning	Raleigh
James Stanton Maple	Jamestown
James Douglas Marsteller	Richmond, VA
Robert Manford Martin, II	Durham
James Rudolph McDaniel, Jr.	Orlando, FL
*Clifton Arthur McDonald	Sylva
John William McGuinn, III	High Point
John Jeffries McKee, Jr.	Charlotte
Mark Edward McLain	Badin
Charles Stewart McLaughlin	Forest City
***Stephen Glenn McLean	Albemarle
Catherine Lee Melton	Roxboro
Bryan Charles Monahan	Rockville, MD
**Frank Albert Morabito	Waxhaw
**Peter Donald Muse	Raleigh
Edward Walker Newsom	Charlotte
**Lisa DiNardo Norris	Jamesville
†Jeffrey Lynn Nussman	Salisbury
Robert Edward Oehman, Jr.	Winston-Salem
Karla Roberson Padgett	Garner
†**George Keith Parish	Raleigh
Timothy Russell Payseur	Hendersonville
Lewis Eugene Petree	Tobaccoville
Hans Reza Piechottka	Charlotte
James Leonard Poole	Mayodan
Gregory Alan Pugh	Raleigh

Martin Keith Richardson	Sophia
** Michael Gray Robertson	Durham
George Boyd Robinson, Jr.	Raleigh
Keith Patrick Rogers	Wallace
Thomas Stanley Ryskiewich	Burlington
Lynn Schrum	Goldsboro
Mark Sterling Sellers	Charlotte
Scott Charles Senecal	Cary
* Nidal Bassam Shaka	Nablus, Jordan
David Andrew Shelton	Rocky Mount
Patricia Ann Silverthorne	Washington
Gregory Eric Slominski	Southern Pines
Harrison Bradford Smith	Charlotte
Fereydoon Souresrafil	Tehran, Iran
David Lee Speer	East Bend
** Brett Randal Starr	Greensboro
* Wesley Edward Stephenson	Wilson
* Susan Vernon Stevens	Madison
Hal Warren Stilley, Jr.	Wilmington
Charles Bruce Stilwell	Charlotte
Kenneth Neil Teeter	China Grove
John Stephen Templeton	Charlotte
David Sanford Thompson	High Point
William Cline Tolley	Bristol, VA
* Greg Andrew Vanhoy	Kernersville
* Randall Todd Voland	Raleigh
Mark LaRue Walker	Laurinburg
Timothy Joseph Walsh	Raleigh
Waite Ross Warren, Jr.	Cary
Mark Allen Weavil	Kernersville
Wayne Gilbert West	Warne
*** William Lester Wheeler	Spencer
* Harry Baker Wilfong, Jr.	Newton
Walter Lee Willard, Jr.	Oak Ridge
Douglas Scott Wilson	Charlotte
Scott Corey Winkler	Hudson
Paul Charles Wood	High Point
James Leonard Yocum	New Bern
Arthur Pharr Young	Harrisburg

BACHELOR OF SCIENCE IN NUCLEAR ENGINEERING

Degree Conferred August 10, 1983

* Vijaykumar Dahya Patel	Kinston
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Degrees Conferred May 12, 1984

*** Douglas Allen Barnett, Jr.	Morganton
†Dennis Edward Brady	Fayetteville
Christopher Wells Caldwell	Raleigh
Stephen Anthony Deskevich	Charlotte
Kenneth Robert Epperson	Westfield
Charles LeRoy Harper, Jr.	Fayetteville
Peter Steele Hastings	Charlotte
Johnny William Henderson, Jr.	Fayetteville
Robert Shane Johnson	Thomasville
Thomas Warren Miralia	Charlotte

Kimberly Ann Phillips	Yadkinville
Charles Woodrow Roberson	Roxboro
**Sabrina Rufty Roberson	Salisbury
**Eric David Sills	Kannapolis
*Louis Samuel Watson, Jr.	Raleigh

School of Forest Resources



BACHELOR OF SCIENCE IN CONSERVATION

Jointly administered by the School of Forest Resources and the School of Agriculture and Life Sciences.

Degree Conferred December 20, 1983

Pamela Gayle Smith Fuquay-Varina

Degrees Conferred May 12, 1984

David Anthony Raeker Charlotte

BACHELOR OF SCIENCE IN FORESTRY

Degrees Conferred June 29, 1983

Matthew Fitzgibbon Hardison	Washington, DC
Stephen Guy Kinzler	Carnegie, PA
*Jo-Ann Mechelle Marco	Raleigh
Mark Edward Robison	Bakersville
Donald Frank Stallings	Greenville

Degrees Conferred August 10, 1983

Douglas Holmes Costin	Kenansville
Kim Formyduval	Whiteville

Degrees Conferred December 20, 1983

James David Allen	Mt. Gilead
Daniel Wayne Forbis	Charlotte
***Keith William Hendrix	Lexington, KY
Alice May Perry	Fayetteville
Tim Hilton Sellers	Wendell
Steven Douglas Sutton	Murfreesboro
Jeffery Lee Ward	Asheville

Degrees Conferred May 12, 1984

Michael Robert Austin	Kernersville
Edward Hunter Birkhead	Covington, VA

† Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

John Walter Connor	.....	New Bern
**Charles Edward Daniels	.....	Merry Hill
John Timothy Friedheim	.....	Charlotte
Charles Lee Haas	.....	Durham
William Crosby Hurst	.....	Charlotte
*Steven Eugene Jacobson	.....	Asheville
David Lister Jennette, Jr.	.....	Windsor
*Michael Joseph Kirchner	.....	Aberdeen, MD
*Gary David McMahan	.....	Andrews
Bernard Griffin Miller	.....	Raleigh
***Keith Perineau Newcomer	.....	Raleigh
H**Karen Elizabeth Papke	.....	Durham
Robert William Ramsey	.....	San Diego, CA
Lori Ann Yedwabnick	.....	Brentwood, NY

BACHELOR OF SCIENCE IN PULP AND PAPER SCIENCE AND TECHNOLOGY

Degrees Conferred December 20, 1983

Todd Alan Hudson	.....	Hickory
Allen Dale Midyette	.....	Engelhard
John Allen Phillips, Jr.	.....	Durham
John William Slaydon	.....	Wooster, OH

Degrees Conferred May 12, 1984

**Anthony Jerome Burnette	.....	Canton
Samuel Jack Chinnis	.....	Wilmington
Sandra Edwina Floyd	.....	Wilmington
Andrew Homer Gresham	.....	Pensacola, FL
Kimberly Carol Hawkins	.....	Enka
Willie Ray Howard, Jr.	.....	Wilmington
Steven Walter Huffman	.....	Havelock
Edward Malcolm Inman	.....	Canton
Karl Peter Jensen	.....	Covington, VA
Margaret Mary Kehoe	.....	Wayne, NJ
***John Sidney Lovelady	.....	Scottsboro, AL
†Daniel Frederick McCulloch, Jr.	.....	Hartsville, SC
Alan Dale Moore	.....	Canton
*Jeffery Darrel Murray	.....	Winston-Salem
Brian Eugene Pressel	.....	Roaring Spring, PA
†John Shepley Schofield, IV	.....	Charlotte
Edwin Neal Stephenson	.....	Mt. Olive

BACHELOR OF SCIENCE IN RECREATION RESOURCES ADMINISTRATION

Degrees Conferred June 29, 1983

William Henry Baker	.....	Greenville
Warren Brent Boykin	.....	Zebulon
Michael Deane Smith	.....	Waterford, OH

Degrees Conferred August 10, 1983

Robert Montgomery Burroughs, Jr.	.....	Charlotte
Dwayne Eric Hellard	.....	Charlotte
Francis Kermit Howard	.....	Charlotte
Lisa Faye Watts	.....	Kannapolis

Degrees Conferred December 20, 1983

William James Biddlecome, Jr.	Clinton, NY
Kathryn Le Anne Creech	Raleigh
Marcie Lynne Fleishman	Fayetteville
Karen Marie Heesch	Jacksonville
Donald Franklin Holloman	Wilson
Arnold Scott Plasse	Owings Mills, MD
Anthony Martin Reynolds	Cary
James Calvin Robinson	Candler
Joyce Kimberly Setzer	Durham
Andrew William Smith	Raleigh
Barbara Jeanne Smith	Winston-Salem

Degrees Conferred May 12, 1984

Thomas Anderson Betts	Raleigh
Bryan James Blanton	Raleigh
H*Kevin Duane Ewbank	Oak Ridge, TN
Natalie Maria Faessler	Hendersonville
James Arthur Heath	Clinton
Debra Ann Hooper	Asheville
John Mark Howell	Charlotte
Mary Elizabeth James	Sanford
*James Allen Jones	Wilmington
Elizabeth Arista McSherry	Semora
Maureen Mary Murphy	Charlotte
Jeffery Darden Price	Clinton
H**Emily Lichty Shaffer	Cary
Jennifer Ann Strickland	Cary
Amy Washburn	Charlotte
*Madelyn Heath White	Raleigh
Gary Wesley Yandle	Roanoke, VA

BACHELOR OF SCIENCE IN WOOD SCIENCE AND TECHNOLOGY

Degree Conferred August 10, 1983

Thomas Alvis Allison, III	Efland
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Degrees Conferred December 20, 1983

Paul Wayne Hoke	Warren, MI
Alan McNairy Smith	Summerfield

Degrees Conferred May 12, 1984

Hugo Robert Andrew Anthony, III	Jacksonville, FL
Douglas Burton Frei	Durham
Avery Max Gardner	Marion
Eric Rea Michael	Lexington
Robert Lee Stuart	Greensboro

School of Humanities and Social Sciences



BACHELOR OF ARTS IN ACCOUNTING

Degrees Conferred June 29, 1983

Sandra Carol Barbour	Raleigh
Donna Anne Coley	Burlington
***Francine Perreault Corcoran	Raleigh
Bruce Adolph Cromartie	Willard
Alan Keith Holt	Kings Mountain
David Alexander Kingman	Winston-Salem
George Clarence Moore	Edenton
Norman George Nelson	Winston-Salem
†Kevin Arthur Thompson	Raleigh
Taraneh Turkzadeh	Ahwaz, Iran

Degrees Conferred August 10, 1983

Janice Rose Allen	Haw River
†Mary Ruth Boone	Jackson
†David Holton Harris	Oriental
David Alexander King	Cary
Brigitte Conger Loftis	Buies Creek
James Edwin Mitchell, Jr.	Raleigh
†Jesse Lee Russo	Charlotte
†Kan Yeung	Raleigh

Degrees Conferred December 20, 1983

Angela Dare Adcock	Holly Springs
Holly Ann Barber	Durham
†Beth Ann Brockschmidt	Springfield, IL
Michael Allen Dickerson	Raleigh
Thomas Gregory Eanes	Burlington
Roxie Ann Gold	Raleigh
Ginger Ann Gregory	Angier
Anthony Lemi Harris	Burlington
Wanda Jayne Hensdale	Winston-Salem
Karen Jean Holly	Sanford
Debra Dowdy Hosch	Raleigh
*Carol Engel Hubbard	Raleigh
James Morrison Johnson	Dunn
Kelly Rae Johnson	Angier
Karen Denise Jones	Winston-Salem
Margaret Mei-Leng Lin	Taichung, Taiwan
Ann Kingsland Maynard	Charlotte
Lori Karen Voyles McDonald	Murphy

† Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

†Jagriti Dhruvkumar Pandya	Raleigh
Terrance Francis Polcaro	High Point
***Elizabeth Gail Strickland Sellers	Knightdale
Theresa Sheehan Starkey	Reading, MA
Judith Lavinder Stinner	Raleigh
Nancy Jo Tyndall	Deep Run
***Jennifer Teresa Vallon	Raleigh
†Mary Lee Weaver	Richmond, VA
Amy Jo West	Fayetteville
†Jack Randolph Whittington, Jr.	Winston-Salem
Gail Althea Williamson	Henderson

Degrees Conferred May 12, 1984

Yvonne Louisa Allgood	Greensboro
Gregory Scott Allison	Old Fort
†Kenneth Milton Arrington	Enfield
†Herbert Kenneth Bales	Black Mountain
†Vincent Dale Barringer	Clemmons
Deidra Annette Bradford	Winston-Salem
*Robin Carole Brock	Dunn
James Loomis Burke	Goldston
Lee Suzanne Byrd	Cary
†Gary Emit Carlton	Durham
Pattie Lee Caury	Raleigh
*Minnette Angelita Cheaves	Henderson
Patricia Johnson Cooke	Apex
*Lyle Scott Cox	Engelhard
Michael David Crane	Greenville
Richard Alan Daughtry	Asheboro
Faith Yvette Dove	Havelock
Carson Herman Durham, IV	Greensboro
Bruce Whitman Elder	Charlotte
*Maureen Patricia Foti	Virginia Beach, VA
Bonnie Spicer Greenhalgh	Raleigh
Judy Lee Gregory	Franklin
Kenneth Harold Griffin	Wilmington
Mark Anthony Hodge	Raleigh
*Anna Lisa Jenkins	Roanoke Rapids
Darrell Ray Johnson	Reidsville
*Sharon Patricia Keener	Highlands
Thomas Edward Kelly	Ardsley, NY
Stephen Allen Lamb	Burlington
Sabrina Suzanne Lambeth	Winston-Salem
*Tammy Karen Lassiter	High Point
Kevin Wayne Link	Winston-Salem
*Hoyle Lee Linker	Asheboro
Robert Miller Lyerly	Charlotte
Timothy John Mack	Fayetteville
Brenda Vinson Medlin	Dudley
Elizabeth Dunham Miller	Potomac, MD
Robert Pope Mitchell	High Point
†Tamara Jeanne Money	Wilmington
Gregory Scott Mooneyham	Raleigh
Sally Craig Moore	Asheboro
Ashley Carlyle Morris, Jr.	Raleigh

James Bradley Moser	Burlington
Judith Lucille Poole	Raleigh
Robin Lang Pulley	Wake Forest
Neil Ashley Roberts	Raleigh
Kimberly Kelly Salmon	Rose Hill
***Betsy Rose Satterwhite	Rocky Mount
Linda Mae Sloan	Charlotte
Michael Glenn Smith	Pink Hill
**Theresa Wentworth Spalding	Raleigh
Edward Clifton Stallings	Garner
John Alan Straub	Camp Hill, PA
*Joanie Carol Sutton	Rocky Mount
*Cathy Elaine Vetter	Raleigh
Dana Robert Walker	Charlotte
Sharon Lynn Whichard	Knightdale
†Carla Joyé Williams	Cary
†Rayne Lea Willis	Raleigh
*Lori Anne Wingate	Grifton

BACHELOR OF ARTS IN BUSINESS MANAGEMENT

Degrees Conferred June 29, 1983

**Sharon Kaye Ayscue	Louisburg
Pedro Beltrez	Queens, NY
†Michael Anthony Bender	Raleigh
†Randy Lee Byrd	Burlington
†*James Walter Cooke	Roanoke Rapids
*Laura Kreis Cousineau	Raleigh
Rickie Allen Davenport	Colerain
Wilton Reese Duncan	Raleigh
Robin Rebecca Dyer	Fayetteville
†James Richard Ellis	Sarasota, FL
†Roderick Eugene Essick	Welcome
†Scott Hamilton Falkner	Raleigh
Kim Rebecca Gatta	Miami, FL
†Amy Timberlake Gray	Lucama
Deborah Earle Gripman	Raleigh
†*Janis Friedlander King	Kensington, MD
Laura Marie Kirchner	Shelby
†Kevin Patrick Krings	Fayetteville
†Laura Susan Laws	Roanoke Rapids
†David Lee Mace	Sanford
Douglas Todd-Springs Maslanka	Charlotte
Cynthia Lynn Nation	Goldsboro
Kenneth Gene Ng	Raleigh
Wayne Dixon Pegram	Cary
Paul Leonard Ray	Charlotte
John Eric Richardson	Kannapolis
†Delmer Warren Rorie	Durham
Patrick Henry Sasser, Jr.	Goldsboro
†David Wallace Stewart, Jr.	Raleigh
†Edward Wells Stowe, Jr.	Washington
†William Lentz Stowe	Washington
†Kevin Arthur Thompson	Raleigh
†William Franklin Thorne	Tarboro
Steven Russell Tosto	Madison
†Julius Daniel Waggoner, Jr.	Salisbury
Michele Sparrow Yates	Apex

† Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

Degrees Conferred August 10, 1983

Ray Martin Adams	Baltimore, MD
Yvonne Louisa Allgood	Greensboro
Dean Alan Andrews	Fayetteville
Sharon Elizabeth Austin	Baltimore, MD
Barry Gene Bell	Raleigh
Kimberly Perry Benfield	Raleigh
Thad Rankin Bisselle	Bethesda, MD
†Mary Ruth Boone	Jackson
Sandra Elaine Burns	Hope Mills
William Hayward Burrell, Jr.	Fayetteville
†Peter Anthony Byers	Riegelwood
†Gary Felton Coley	Raleigh
Charles Jeffrey Cromer	Charlotte
Tina Teresa Ewing	Durham
Earl Davis Farthing, Jr.	Elizabethtown
†Thomas Kevin Flaherty	Asheville
Ronald Alan Foreman	Virginia Beach, VA
†David Holton Harris	Oriental
Phillip Hester Huggins	Lumberton
†Clark Carl Kephart	Clinton
Patricia Erin McGrail	Charlotte
Stanford Houston Morris	Annapolis, MD
Michael Wayne Palmer	Shelby
†Peter Pappas	Charlotte
James Gregory Poole	Raleigh
†David Murphy Powers	St. Pauls
†Todd Bennett Rowley	Wilmington
Michael Neil Setzer	Catawba
Shahin Shahin	Chapel Hill
David Lewis Sherman	Whitsett
†Joseph William Trollinger, Jr.	Burlington
†Steven Ray West	Fayetteville
Eric Paul Woods	Bethesda, MD
Joseph Redmond Woodside	Clinton
†Kan Yeung	Raleigh
Thomas Gordon Young	Bethlehem, PA

Degrees Conferred December 20, 1983

†Daniel Evan Allen	St. Louis, MO
†Amy Rena Barnes	Raleigh
Geoffrey John Bartlett	Raleigh
James Herschel Belk	Charlotte
†Perry Raymond Boseman	Raleigh
Richard Franklin Bowling, II	Shelby
†Warren Franklin Brendle	Drexel
Joe Davis Brinson	Kenansville
†Robert Kingsley Brock	Chattanooga, TN
†Beth Ann Brockschmidt	Springfield, IL
Kathy Lynne Bruce	Mooresville
David Allen Butts	Roanoke Rapids
James Tommie Callihan	Dublin
†Alfred Bates Canon	Montreat
†Philip Price Cave	Rocky Mount
Billy Warren Cavenaugh	Wallace
Thomas Lee Churchwell, Jr.	Cary
†Timothy Neal Cockerham	Denver
Michael William Coffey	Hickory

† Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

Shelia Joyce Coffey	Thurmond
†*Philip Baird Cook	Hickory
Craig Walter Cox	Milford, PA
Robert Bradford Cray	Kinston
Elizabeth Anderson Culler	Raleigh
Charles Edward Dameron, IV	Greensboro
Monnie Marie Davis	Graham
†Robert Thomas Dooley, III	Charlotte
†Paul Henry Dunne	Greensboro
Kyle Clifton Eller	Statesville
Belynda Leigh English	Bladenboro
Daniel Brennan Evans	Raleigh
†*Eric Scott Farber	Raleigh
†Conrad Alan Goree	Durham
†Charles Michael Gunter	Siler City
†Tony Wilson Gupton	Franklinton
Russell Douglas Hall	High Point
Carolyn Ann Harlow	Raleigh
†Gail Yvonna Hayes	Durham
†Thuy Ngoc Ho	Raleigh
James Butler Holding	Wake Forest
†Daniel Cole Humphrey	Garner
Jacqueline Juanita Jackson	High Point
Roland Gray Jarvis, Jr.	Wilkesboro
†Robert Lee Jolly	Shelby
†Jerry Lynn Jones	Fuquay-Varina
†Ingo Martin Justick	Neptune, NJ
†Janet Mary Kelley	Raleigh
†William Keith Kennerly	Greensboro
Kim Margaret Krajack	Charlotte
†Charles Michael Lancaster	Smithfield
†Robert Wayne Lawson	Eden
†Sharon Kay Lindsay	Raleigh
Stephen Anthony Earl Lytle	Cary
Donna Lea Massie	Rocky Mount
†Judith Frances Matthis	Wilson
Susan Howard McDuffee	Fayetteville
Terry Ralph McFatter	Goldsboro
Amos Leslie McLemore, III	Rolesville
†Gregory Keith McNamara	Raleigh
Laurie Ann McSwain	Raleigh
Kenneth Francis Melley	McLean, VA
†James Marion Millican, Jr.	Greensboro
†John Edward Mills, Jr.	Mt. Airy
Evelyn Lorene Morris	Charlotte
†Brice Krites Murphy	Winston-Salem
John Henry Myers	Winston-Salem
†Richard Edwin Nellis	Charlotte
†***Karen Halusa Ordanic	Raleigh
†Philip Dean Osborne	Lexington
†Jagriti Dhruvkumar Pandya	Raleigh
Richard Wimbish Paschal	Burlington
†Ronald Thomas Patterson	Statesville
†Jeffrey Merrill Philips	Charlotte
Paula Sue Prestwood	Lenoir
†Lee Ann Price	Gastonia
†Angela Lorraine Rowe	Richmond, VA
Jeffrey Allan Russell	Raleigh
Yvonne Jones Scott	Raleigh

† Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

†Linda Joe Seeds	Canfield, OH
Mark Sellers	Southern Pines
†Robert Jason Shive	Salisbury
†Linda Lee Snell	Rockville, MD
†Denise Lenore Stevenson	Raleigh
Bennie Morris Surles	Raleigh
†Donna Lee Tanner	Benson
Michael Anthony Thompson	Charlotte
Philip Anthony Vivona	Colts Neck, NJ
†Colby Alden Warren	Greensboro
†William Bruce Watson	Fairmont
*Elizabeth Gaither Weatherly	Elizabeth City
Diane Karen Wells	Raleigh
Thomas Bayley Wharton	Winston-Salem
†Jack Randolph Whittington, Jr.	Winston-Salem
†Dwight Marvin Wright	Apex

Degrees Conferred May 12, 1984

†David Arthur Allen	Charlotte
†Kenneth Milton Arrington	Enfield
†*Rolf Johannes Asbrook	Charlotte
†Eunice Ukachi Asogu	Amakohia-Ikeduru, Nigeria
†*Samuel Howard Aycoth	Indian Trail
Kevin Ignatius Bagatta	Stony Brook, NY
†Herbert Kenneth Bales	Black Mountain
†Bryan Alan Bannister	Kinston
†James Budhy Barber	Raleigh
Kevin Glenn Barker	Winston-Salem
†Ritchie Allen Barnette	Raleigh
†Vincent Dale Barringer	Clemmons
John Robin Baucom, III	Garner
Melinda Susanne Beck	Asheboro
Michelle Lynn Beley	Mahwah, NJ
Timothy Ross Bell	Statesville
†Gwendolyn Ann Britt	Orrum
Tracy Ellen Broome	Monroe
†Harriett Elizabeth Brown	Charlotte
†Tillman Wright Brown	Gastonia
Walter Robert Byrd	Arden
†Gary Emit Carlton	Durham
†Terry Scott Cheek	Burlington
†Dean Andrew Collins	Raleigh
***Michael Terance Constantino	Clayton
Judith Ann Conway	Cary
Heather Louise Cox	Raleigh
Dennis James Crowder	Peachland
†Robert Lee Davis	Winston-Salem
Christian Jeffery Dieterich	Stony Brook, NY
Kevin Thomas Dolan	Greensboro
†*Lynn Dawson Dolby	Raleigh
Stacie Lynn Donley	Winston-Salem
Scott Orander Douglas	Winston-Salem
†Mark Edwin Draughn	High Point
†Charles Brent Edwards	Marshville
†Charles Howard Edwards, Jr.	Raleigh

† Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

†James Joseph Facciolo	Matthews
†Patricia Ann Farmer	Raleigh
Michael John Figura	Tonawanda, NY
Deborah Cox Fox	Hillsborough
Joseph Lee Freeman	Oxford
Lori Ann Freeze	Kannapolis
Julian Beattie Friday, III	Greensboro
†Rufus Manford Friday	Gastonia
Beverly Arlene Fuller	Henderson
Michele Lynn Gall	Matthews
†Tracy Leland Gaskins, III	Cherryville
Lisa Ames Gatlin	Burlington
Stephanie Lynne Godsey	Roanoke, VA
Ronda Jean Golden	Climax
Jay Howell Goodwin	Kinston
†Douglas Scott Gosden	Ridgefield, CT
†Paul Richard Green	Charlotte
Jacqueline Griggs	Bethel
†Donna Jean Gwynn	Henderson
†John Bradford Hagler	Raleigh
†David Nichols Harris	Raleigh
Joann Hassell	Williamston
†Patricia Dianne Haynie	Greenville
Mark Christopher Hemric	Winston-Salem
†George Francis Henry, III	Gastonia
Alice Erin Hickey	Chapel Hill
William Maurice Hill, III	Louisburg
**Jeffrey Grinbergs Hirsch	Somerville, NJ
†Tuyet Ngoc Thi Ho	Chapel Hill
**William Eugene Holmes	Hickory
Edward Wayne Honeycutt	Salemburg
†Carolyn Florence Hoover	Harrells
†Christopher Benjamin Hughes	Charlotte
†Glenn David Humbert	Maxton
†Carey Johnson Hunter, Jr.	Raleigh
†Sandra Kay Hyder	Asheville
†*DeAnne Delmar Johnson	Raleigh
†Elizabeth Hunter Johnston	Charlotte
Bryan Eugene Jones	Lewisville
Mary Byrd Jones	Jacksonville
Paul Christopher Jones	Knoxville, TN
Richard Scott Joseph	Greensboro
David Alexander Kingman	Winston-Salem
Albert William Klemme, III	High Point
†Jeffrey Houston Knight	Madison
Diane Marie Kuhn	Durham
***Carol Shackelford Kurth	Raleigh
†Diane Joan Lail	Mickleton, NJ
†Randy Montgomery Lait	Newton Grove
Richard Elliott LaRose	Vestal, NY
Preston Earl Laughinghouse	Washington
†Benton Craig Lisk	Raleigh
Susan Kelly Lloyd	Sanford
†Linda Susan Lompa	Raleigh
Andrea Mary Lysiak	Greensboro

Kimberly Ann Mack	Wilmington
André Anthony Marks	High Point
†David Alan May	Franklinton
†*Scott Timothy McCauley	Durham
Patricia Ann McKinney	Jacksonville
†Michael Kieran McMahon	Raleigh
†Walter Thomas Mills	Lake Waccamaw
Melanie Fay Mingle	Lenoir
†John Hughes Moore	Asheville
†Marjorie Carol Morgan	Raleigh
Melonie Ruth Moultry	Winston-Salem
William Wells Neal, Jr.	Charlotte
†Kathleen Elizabeth O'Connell	Rocky Mount
Steven Andrew Odams	Weston, CT
Mitchell Wade O'Neal	Raleigh
†William Redden Owens	Wilson
†Craig Wilson Peatross	Winston-Salem
Charles Russell Peeler	Charlotte
†William Kenneth Pipkin	Raleigh
Dorsey Ernest Poole, III	Raleigh
†Carolyn Rose Powell	Raleigh
Daniel William Primeau	Cary
Mark Abram Prioleau	Washington, DC
John Dillard Reekes, III	Petersburg, VA
†Albert Lee Renaud	Charlotte
†Catherine Ann Rheäume	Greensboro
†William Lamar Rhew, II	Cherryville
†*Kevin Drew Richardson	Pittsburgh, PA
†Carolyn Leigh Ritch	Laurinburg
†Wade Ellerbe Ritter	Raleigh
Henry Benjamin Roberson, Jr.	Rocky Mount
**Sharon Christine Robinson	Raleigh
†Thomas Connie Robinson	Asheboro
Karen Andrea Roboz	Waxhaw
†Timothy Chadwick Rogers	Wilmington
Maurice Wade Rozier	Lumberton
John Moore Salmon	Wallace
†Ralph Longwell Sanders, III	Raleigh
Andrea Jean Schumacher	Stuart, FL
†Melody Stowe Scott	Apex
Glen Lee Shanor, III	Fayetteville
†Tracy Ann Sher	Hickory
†Marshall Mahan Siler	Louisville, KY
†Mark Edward Skinner	Fort Washington, MD
Frances Lynne Smith	Cherryville
Nancy Smith	Oak City
†Sheri Anne Spryn	Charlotte
†Edward William Stepnoski	New Bern
Georgia Michelle Steppe	Farmville
Helen Delane Stewart	Sanford
David Clifton Strickland	Wendell
Toni Torme Tenpenny	Asheville
Benjamin Scott Thomas	Burlington
Alan Maxton Thompson	Goldsboro
†Carolyn Theresa Torain	Roxboro
†**Debra René Torrence	Raleigh
Karen Denise Troutman	Fairfax, VA

Melanie June Vick	Nashville
†Dwight Henry Wadford, Jr.	Raleigh
†David Eric Waff	Statesville
†Philip Lee Ward	Charlotte
Allison Marie Watkins	Horseheads, NY
James Floyd Watkins, Jr.	Spring Lake
Leigh Ann Thorsen Watts	Southport
Philip John Weber	Northport, NY
†Allen Braswell Weeks	Nashville
†Duane Costa Wesche	Raleigh
†Elliott Todd White	Lincolnton
†Stephen Bennett White	Warrenton, VA
†**Charita Nanette Whitehurst	Belvidere
Jerri Lee Wilfong	Hickory
†Carla Joyé Williams	Cary
†Cravon Allen Williams	Salemburg
†Rayne Lea Willis	Raleigh
†Benjamin Charles Wilson	Winston-Salem
†Jonathan Wade Wilson	Hendersonville
†Dennis Alan Winstead	Louisburg
†Diane Marie Woodyard	Salisbury
†Pamela Sue Wright	Winston-Salem
Garrett Eugene Yelton	Concord

BACHELOR OF ARTS IN ECONOMICS

Degrees Conferred June 29, 1983

†Michael Anthony Bender	Raleigh
William Garrison Brown, Jr.	Charlotte
†Randy Lee Byrd	Burlington
†*James Walter Cooke	Roanoke Rapids
†James Richard Ellis	Sarasota, FL
†Roderick Eugene Essick	Welcome
†Scott Hamilton Falkner	Raleigh
†Amy Timberlake Gray	Lucama
Lance Randolph Johnson	Annapolis, MD
†*Janis Friedlander King	Kensington, MD
†Kevin Patrick Krings	Fayetteville
†Laura Susan Laws	Roanoke Rapids
†David Lee Mace	Sanford
†Delmer Warren Rorie	Durham
†David Wallace Stewart, Jr.	Raleigh
†Edward Wells Stowe, Jr.	Washington
†William Lentz Stowe	Washington
†William Franklin Thorne	Tarboro
†Julius Daniel Waggoner, Jr.	Salisbury

Degrees Conferred August 10, 1983

†Peter Anthony Byers	Riegelwood
†Gary Felton Coley	Raleigh
†Thomas Kevin Flaherty	Asheville
William Dudley Gwaltney	Charlotte
†Clark Carl Kephart	Clinton
†Peter Pappas	Charlotte
†David Murphy Powers	St. Pauls
†Todd Bennett Rowley	Wilmington

† Co-major

* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

†Jesse Lee Russo	Charlotte
†Joseph William Trollinger, Jr.	Burlington
†Steven Ray West	Fayetteville

Degrees Conferred December 20, 1983

†Daniel Evan Allen	St. Louis, MO
†Amy Rena Barnes	Raleigh
†Perry Raymond Boseman	Raleigh
†Warren Franklin Brendle	Drexel
†Robert Kingsley Brock	Chattanooga, TN
†Alfred Bates Canon	Montreat
†Philip Price Cave	Rocky Mount
†Timothy Neal Cockerham	Denver
†*Philip Baird Cook	Hickory
†Robert Thomas Dooley, III	Charlotte
†Paul Henry Dunne	Greensboro
Tina Teresa Ewing	Durham
†*Eric Scott Farber	Raleigh
†Conrad Alan Goree	Durham
†Charles Michael Gunter	Siler City
†Tony Wilson Gupton	Franklinton
†Gail Yvonna Hayes	Durham
†Thuy Ngoc Ho	Raleigh
†Daniel Cole Humphrey	Garner
†Robert Lee Jolly	Shelby
†Jerry Lynn Jones	Fuquay-Varina
†Ingo Martin Justick	Neptune, NJ
†Janet Mary Kelley	Raleigh
†William Keith Kennerly	Greensboro
†Charles Michael Lancaster	Smithfield
†Robert Wayne Lawson	Eden
†Jerry Jay Lewis	Cary
†Sharon Kay Lindsay	Raleigh
*†John Kinney Mashburn	Lexington
†Judith Frances Matthis	Wilson
Patricia Erin McGrail	Charlotte
†Gregory Keith McNamara	Raleigh
†James Marion Millican, Jr.	Greensboro
†John Edward Mills, Jr.	Mt. Airy
†Brice Krites Murphy	Winston-Salem
†Richard Edwin Nellis	Charlotte
†Philip Dean Osborne	Lexington
†Ronald Thomas Patterson	Statesville
†Jeffrey Merrill Philips	Charlotte
†Lee Ann Price	Gastonia
Will Allen Robbins	Greensboro
†Angela Lorraine Rowe	Richmond, VA
Shahin Shahin	Chapel Hill
†Robert Jason Shive	Salisbury
†Linda Lee Snell	Rockville, MD
†Denise Lenore Stevenson	Raleigh
†Donna Lee Tanner	Benson
H†Colby Alden Warren	Greensboro
†William Bruce Watson	Fairmont
†Mary Lee Weaver	Richmond, VA
†Dwight Marvin Wright	Apex

Degrees Conferred May 12, 1984

†David Arthur Allen	Charlotte
†*Rolf Johannes Asbroek	Charlotte
†Eunice Ukachi Asogu	Amakohia-Ikeduru, Nigeria
†*Samuel Howard Aycoth	Indian Trail
†Bryan Alan Bannister	Kinston
†James Budhy Barber	Raleigh
†Ritchie Allen Barnette	Raleigh
†Gwendolyn Ann Britt	Orrum
†Harriett Elizabeth Brown	Charlotte
†Tillman Wright Brown	Gastonia
†Terry Scott Cheek	Burlington
†Dean Andrew Collins	Raleigh
†Robert Lee Davis	Winston-Salem
†*Lynn Dawson Dolby	Raleigh
†Mark Edwin Draughn	High Point
†Charles Brent Edwards	Marshville
†Charles Howard Edwards, Jr.	Raleigh
†James Joseph Facciolo	Matthews
†Patricia Ann Farmer	Raleigh
Maureen Elizabeth Fitzgerald	Elsmere, NY
†Rufus Manford Friday	Gastonia
†Tracy Leland Gaskins, III	Cherryville
†Douglas Scott Gosden	Ridgefield, CT
†Paul Richard Green	Charlotte
†Donna Jean Gwynn	Henderson
†John Bradford Hagler	Raleigh
†David Nichols Harris	Raleigh
†Patricia Dianne Haynie	Greenville
†George Francis Henry, III	Gastonia
†Tuyet Ngoc Thi Ho	Chapel Hill
†Carolyn Florence Hoover	Harrells
†Christopher Benjamin Hughes	Charlotte
†Glenn David Humbert	Maxton
†Carey Johnson Hunter, Jr.	Raleigh
†Sandra Kay Hyder	Asheville
†Elizabeth Hunter Johnston	Charlotte
†Jeffrey Houston Knight	Madison
†Diane Joan Lail	Mickleton, NJ
†Randy Montgomery Lait	Newton Grove
†Benton Craig Lisk	Raleigh
†Linda Susan Lompa	Raleigh
†David Alan May	Franklinton
†*Scott Timothy McCauley	Durham
†Michael Kieran McMahon	Raleigh
†Walter Thomas Mills	Lake Waccamaw
†Tamara Jeanne Money	Wilmington
†John Hughes Moore	Asheville
†Kathleen Elizabeth O'Connell	Rocky Mount
†William Redden Owens	Wilson
†Craig Wilson Peatross	Winston-Salem
†William Kenneth Pipkin	Raleigh

†Carolyn Rose Powell	Raleigh
†Albert Lee Renaud	Charlotte
†Catherine Ann Rheaume	Greensboro
†William Lamar Rhew, II	Cherryville
†*Kevin Drew Richardson	Pittsburgh, PA
†Carolyn Leigh Ritch	Laurinburg
†Wade Ellerbe Ritter	Raleigh
†Thomas Connie Robinson	Asheboro
†Timothy Chadwick Rogers	Wilmington
†Ralph Longwell Sanders, III	Raleigh
†Melody Stowe Scott	Apex
†Tracy Ann Sher	Hickory
†Marshall Mahan Siler	Louisville, KY
†Mark Edward Skinner	Fort Washington, MD
†Sheri Anne Spryn	Charlotte
†Edward William Stepnoski	New Bern
†Carolyn Theresa Torain	Roxboro
†**Debra René Torrence	Raleigh
†Dwight Henry Wadford, Jr.	Raleigh
†David Eric Waff	Statesville
James Stephen Walker	Gastonia
†Philip Lee Ward	Charlotte
†Allen Braswell Weeks	Nashville
Diane Karen Wells	Raleigh
†Duane Costa Wesche	Raleigh
†Elliott Todd White	Lincolnton
†Stephen Bennett White	Warrenton, VA
†**Charita Nanette Whitehurst	Belvidere
†Crayon Allen Williams	Salemburg
†Benjamin Charles Wilson	Winston-Salem
†Jonathan Wade Wilson	Hendersonville
†Dennis Alan Winstead	Louisburg
†Diane Marie Woodyard	Salisbury
†Pamela Sue Wright	Winston-Salem
Robert Eugene Youngblood, Jr.	Raleigh

BACHELOR OF SCIENCE IN ECONOMICS

Degree Conferred June 29, 1983

William Lowell Page	West Caldwell, NJ
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Degrees Conferred August 10, 1983

William Edward McCallum, Jr.	Raleigh
William Scott Sahlie	Charlotte

Degrees Conferred December 20, 1983

Daniel James Brannan	Bowie, MD
James Grant Goodling	Raleigh
Edwin Monroe Lore	Smithfield
Dorothy Lungen Meyer	Raleigh
Kenneth Gray Overbey	Greensboro

Degrees Conferred May 12, 1984

Paul Jeffrey Gipko	Pittsburgh, PA
Stephen David Gorsuch	Durham

Richard James Negrete	Bethlehem, PA
†Jeffrey Lynn Nussman	Salisbury
*Lisa Jan Rogerson	Williamston
Dennis Alan Setzer	Conover
Don Edward Wall	Winston-Salem

BACHELOR OF ARTS IN ENGLISH

Degree Conferred June 29, 1983

**Sarah Stone Jones	Greensboro
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Degrees Conferred August 10, 1983

Cynthia Moore Callahan	Fayetteville
Kathryn Ann Payne	Clayton

Degrees Conferred December 20, 1983

H David Durwood Baggett	Wilmington
Elizabeth Lee Berry	Raleigh
Gladys Hill Boyette	Raleigh
Lori Shawn Cottle	Raleigh
*Betty Fried Jones	Silver Spring, MD
Charlotte Ann King	Raleigh
*Judith Wright Mathews	Raleigh
Ida Teresa Caudill Myers	Havelock
**Lynette Smith Parker	Raleigh
Betsy Ross	Rockingham
*Judith Kay Whatley	Raleigh

Degrees Conferred May 12, 1984

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Deborah Lee Boyd	Raleigh
Lola Kay Britt	Goldsboro
Mark Earl Britt	Lumberton
Susan Otto Evans	Raleigh
Mark Russell Goodwin	Charlotte
†*Gilbert Kenneth Gray, Jr.	High Point
***Lucy Noble Inman	Raleigh
Kevin Brehon Kimrey	Elkin
*Patricia Campbell Martin	Raleigh
Patrick Kevin McManus	Chapel Hill
**Bonnie Carol Walker Myrick	Hillsborough
Angelyn Mitchell Pulley	Clayton
**Jean Huske Schaefer	Fayetteville
Helen Alyce Smith-Juday	Clarksville, VA
**Gail Smith Wallace	Raleigh
Elizabeth Jean Walters	Cary
Cynthia June Weber	Charlotte
Betty Jean Lynch Whitley	Smithfield

BACHELOR OF SCIENCE IN ENGLISH

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Anthony Joseph Schifano	Charlotte

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Lila Jabarzadegan SorkhabiTeheran, Iran

Degree Conferred December 20, 1983

Hoang Thi HoRaleigh

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†*Gilbert Kenneth Gray, Jr.High Point

Marta LerouxQuito, Ecuador

BACHELOR OR ARTS IN HISTORY

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Gregory Stephen HuntHenderson

**Jean Heston MarshRaleigh

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H*Jane Ellen ChristophersonRaleigh

Edmond Ragland CoxeDarlington, SC

June Elizabeth LancasterRaleigh

Robert Preston McGeeCharlotte

Michael Joseph MullinaxSpring Lake

Aaron Earl Smith, Jr.Apex

Degrees Conferred May 12, 1984

Gregory Scott BowserPotecasi

Robert Keith EllingtonCommack, NY

Aaron Stewart HayesRaleigh

*Eugene Griffin JenkinsKinston

John Thomas PeelerRaleigh

William David WallRaleigh

Charles Raymond WhelissRaleigh

Foster Mason WhitlockKinston

BACHELOR OF SCIENCE IN HISTORY

Degree Conferred December 20, 1983

Debra Kaye Dew WhareyTarboro

Degree Conferred May 12, 1984

Richard CostelloGarner

BACHELOR OR ARTS IN MULTI-DISCIPLINARY STUDIES

Degrees Conferred December 20, 1983

Gary David AndersonGreensboro

David Eugene GatttonFalls Church, VA

George Welch Liles, Jr.Concord

David Walter Van Gieson, IIIRaleigh

Degree Conferred May 12, 1984

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BACHELOR OR ARTS IN PHILOSOPHY

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Donna Kay Barnes Knotts Island
Richard Shelton Edmondson Tarboro

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Frank James Castrignano Wilkes-Barre, PA
Rory McNair Daniel Raleigh
Hermanda Bernetta Hayes Elizabeth City
John Stephen Pappas Buffalo, NY
Debra Lynn Phillips Roanoke Rapids
Samuel Paul Senter Gastonia

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Lisa Marie Barnes Miami, FL
Margaret Rebecca Craig Wilmington
Robert Alexander Frye Kannapolis
Danny Stuart Hill Pink Hill
Hoy Jeffery Johnson Asheville
David Robinson Kornegay Pleasant Garden
Charles Douglas Lattimore Fayetteville
Timothy Darryl Moose Rockwell
Angela Gail Murphy Youngsville
Paula Louise Nicholson Enfield
Mitchell Dean Register Whiteville
Ailene Michiko Surles Fayetteville

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***Jeanne Marie Bennett Kensington, MD
William Benjamin Blades, IV Raleigh
Brent Curtis Bowman Newton
Lee Melvin Cecil High Point
Margie Denning Cooper Willow Springs

***Barry Lynn Creech	Smithfield
Virginia Annette Edwards	Gaston
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Stephen Derrick Finch	Roanoke Rapids
Francis Edward Hannigan	Scarsdale, NY
Gordon Clifford Hargrove	Cary
Virginia Elizabeth Jones	Raleigh
Albert Strayer Kemper, IV	Lynchburg, VA
*Jeffrey Todd Kinsley	Durham
Sandra Elizabeth Latta	Mocksville
Douglas Robert Lumsden	Bowie, MD
Gregory Vincent Lynch, Jr.	Raleigh
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Marty Dale Matthews	Raleigh
Kimberly Ann McBride	Henderson
Monica Elaine Millwood	Garner
†Marjorie Carol Morgan	Raleigh
John Nelson Ogburn, III	Asheboro
Timothy Brooks Owens	Kinston
H**Robert Earl Powers, Jr.	New Bern
David Clark Ramsey	Roxboro
Karl Sydney Reid	Fayetteville
†John Proctor Rendleman	Salisbury
Michael Hurlin Sawyer	Raleigh
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Priscilla Ann Snipes	Sanford
John William Stillion	Cullowhee
Miranda Ashley Thayer	High Point
Byron Harvey Wells	Kinston
Kevin Colon Williams	Hamlet
Michael Lynn Wood	Burlington
Michael Donner Wynne	Goldsboro

BACHELOR OF SCIENCE IN POLITICAL SCIENCE

Degree Conferred December 20, 1983

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Anne Douglas Almond	Midland
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Meri Landra Wilson	Hayesville

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Barbara Patricia Bruchon	Cary
Harold Hodgkin Reddick, Jr.	Youngsville

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Cathy Lynn Fuller	Morehead City
Bettie Sanders Lee	Raleigh
Etta Marie McClairy	Durham
Michael Eugene Monger	Fayetteville
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Graeme Hamilton Shaw	San Francisco, CA
Martha Richards Sprague	Annapolis, MD
†Keith Gordon Wooten	Winston-Salem

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Merry Melody Bousman	Garner
*Wendy Gayle Boyd	Winterville
Cyd Shauneille Buck	New Bern
Lisa Michelle Burchette	Hallsboro
Mollie Campbell	Red Springs
Teena Rachel Cloninger	Ellerbe
*Barbara Fleming Doster	Raleigh
Winston Thomas Hall	Durham
Lisa Marie Harty	Garner
Donna Ruth Johnson	Raleigh
Maurice Manfred Krochmal	Asheville
Jane Elizabeth Harrell Learn	Alexandria, VA
Shannon Moore Newman	Jacksonville
H***Linda Claudette Rudisill	Raleigh
André Arceno Scott	Raleigh
Laura Anne Still	Wilmington
Audrey Elaine Tart	Wade
***Rhonda Gayle Beeson Wilson	High Point

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†***Karen Halusa Ordanic	Raleigh
†Linda Jo Seeds	Canfield, OH
Kimberly Whiteman	Winston-Salem

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†*DeAnne Delmar Johnson	Raleigh
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William Mark Patterson	Sanford
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Jerome Leigh Small	Fayetteville
Delia Ellen Taylor	Raleigh

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Arthur Terrell Jones, III	Banner Elk
Velerie Ann Moore	Cary
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Karen MacQueen Brown	Garner
Carol Ann Carite	Raleigh
*Caressa Lee Davison	Upper Marlboro, MD
Christopher John Handley	Charlotte
Velvet Anne Key	Winston-Salem
David Phillip Martin	Garner
Shelton Murphy	Goldsboro
Miriam Gaye Pearson	Raleigh
Hellen Lavern Phillips	Edgefield, SC
Mary Elise Price	Siler City
Andrea Delores Sanders	Charlotte
Heather Margot Simpson	Potomac, MD
Randy Lee Swetman	Arlington Heights, IL
Clifford Burgess Thomas, Jr.	Franklinton
*Keith Gordon Wooten	Winston-Salem

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Patricia Ellen Andrews	Durham
Antonio Autry	Bladenboro
Mary Arrasmith Cates	Hillsborough
**LuLane Coates Chasteen	Smithfield
Alison Renee Evans	Charlotte
John Albert Evans, Jr.	Raleigh
Jeanette Marie Foote	Raleigh
Susan Maria Foster	High Point
Robert Lee Hall, Jr.	Butner
Dawn Lee Haney	Tempe, AZ
Elizabeth Wren Harris	Raleigh
Anthony Grant Haynes	Raleigh
Melissa Ann Hinson	Charlotte
Angela Denise Holloway	Roxboro
Marjorie Josey Holmes	Sanford
Michael Dean Hurlbert	Charlotte
Harriett John Kalevas	Charlotte

Linda Jane Kelder	Washington
Kristen Marie Landreth	Walkertown
*Mary Jackson Laughter	Washington
Pamela Jane Livengood	Winston-Salem
Nina Lorraine Lupoletti	Huntington, NY
Marian Dale Marshall	Greensboro
Patricia Arlene McDaniel	Stedman
Megan Mary McGarvey	Havelock
Melinda Lee Pappas	Winston-Salem
Kelly Ann Parker	Falls Church, VA
**Connie Lynn Patterson	Henderson
Kimberly Jo Phillips	Henderson
Patricia Ann Pippin	Birmingham, MI
Gregory Earl Pittman	Wilson
†John Proctor Rendleman	Salisbury
Christina Marie Salerno	East Flat Rock
William Dean Sessions	Atlanta, GA
Lisa Lynn Sherrill	Statesville
Susan Lamb Stevens	Raleigh
Gary Leon Stilley	New Bern
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James Edward Teddy	Shelby
Nathan Anthony Warren	Spruce Pine
Robert David Winstead	Nashville

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**Dana Raene Isley	Burlington
Mary Martha Phelps	Raleigh
Henry Lawrence Trevathan, Jr.	Raleigh

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Suzanne Hollie Karp	Raleigh
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Degrees Conferred May 12, 1984

Rebecca Davenport Basnight	Raleigh
*Kathy Sue Bowers	Hagerstown, MD
**Lois Althea Chouinard-Unger	Raleigh
Elaine Diane Cummings	Garner
H**Teresa Ann Dearth	Durham
Eva Renee Craig Fisher	Canton
Jennifer Ann Goodwin	Raleigh

School of Physical and Mathematical Sciences



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†Mara Olivia Massel	Raleigh

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H**Richard Lee Plant	Raleigh
James Marion Wimberley	Glen Arm, MD

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***Richard Glynn Cooper	Salemberg
†David Anthony Hedeem	Raleigh
Lindsay Love McGill	Matthews
Laura Lynn Pike	Jacksonville
H**Monica Reichman	Raleigh

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Degree Conferred June 29, 1983

Patrick Mason Cole	Gastonia
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Degrees Conferred August 10, 1983

H***Phillip Arthur Clement, III	Raleigh
*Valerie Grace Doggett	Raleigh
Lawrence Edward Hamel	Cortez, CO

Degrees Conferred December 20, 1983

†***Anthony William Reeve	Durham
John David Winkler	Boone

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†Susan Elaine Danchi	Carrboro
Anne Gardner Glenn	Winston-Salem
David Marshall Graves	Hickory
William Thomas Guyton	Raleigh
H***Yvonne Maria Heinrich	York, PA
H**George Clyde McBane	Morganton
Robert John McGivney	Flanders, NJ
Loren Elizabeth McLamb	Dunedin, FL
Mary Anna Murrelle	Boone
Helen Rose Naylor	Raleigh
†H*Charles David Pendleton	Fayetteville

H*William Burtch Sanborn, Jr.	Mt. Airy
H***Mark Tedder	Greensboro
Stephanie Doris Wagner	Raleigh

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William Burnett Brown	Durham
Gaither Clyde Frye, Jr.	High Point
Scott Allen Niebling	Cary
Jack Joseph Rouse	Kinston
Stephen Allen Weikert	Cary

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Mark David Dowell	Winston-Salem
John Richard Hart	Lexington
Patrick Moran	Poughkeepsie, NY

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James Davis Armstrong, Jr.	Durham
George Batten, Jr.	Cary
**Suzanne Adele Benedict	Paoli, PA
Jonathan Watson Bonesteel	Hendersonville
Regie Leslie Bryant	Lenoir
Michael John Brzezinski	Greensboro
Robin Marie Burbank	Asheville
Sarah Irene Burton	Reidsville
Kimberly Sue Carawon	New Bern
*Robert Dixon Carter	Morganton
Kenneth Wesley Cobb	Burlington
Christopher Gerard Connors	Cary
Stephen Robert Daniels	Greensboro
**Nancy Jean Dunn	Raleigh
John Dowd Elliott, Jr.	Fuquay-Varina
Noreen Marie Feely	Sparta, NJ
†Karen Kay Fleischer	Port Allegany, PA
James O'Neal Fowler	Burlington
Todd Dickson Gatts	Cary
Warren Evan Gool	Goldsboro
William James Gray	Raleigh
Charles William Halloran, Jr.	Raleigh
Gayle Harris	Charlotte
John Mark Harrison	Burlington
Claud Henry Huggins, III	Hickory
Thomas Hardin Jeffries	Henrietta
***Gregory Jay Johnston	Durham
Bhaskar Khana	Johannesburg, South Africa
†Jerry Jay Lewis	Cary
James Lee Little, Jr.	Warrensville
Alison Maddox	Asheville
*Olive Gayle McPherson	Elizabeth City
*Lou Anne Sides	Concord
Mardecia Gaynell Stallings	Chinquapin
James Braddock Stokes	Lumberton

***Cynthia Rae Terry	Winston-Salem
*William Lewis Tickel	Roanoke Rapids
*John Albert Toebes, III	Virginia Beach, VA
Nancy Atkinson Walden	Raleigh
James David Williams	Louisburg
Pamela Kaye Winslow	Monroe
Keith Ray Wood	Burlington

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Kelly Jean Anderson	Burlington
**Michael Edward Arnold	Bristol, TN
Allen Wade Austin	Granite Falls
Johnny Allen Baker	Angier
Darrell Randolph Barlow	Boomer
†Andrew Eppard Barnett	Raleigh
Kenneth Ray Barnhouse	Garner
Dale Thomas Benedict	Warren, MI
Mark Carver Bridges	Shelby
Robert Kean Bubnis	Mechanicsburg, PA
Eugene Gale Buck	Raleigh
*Edmund Bernard Burnette	Whiteville
Elizabeth Graham Cameron	Jacksonville
***Gale Margaret Chamblee	Raleigh
Michael Douglas Clark	New Bern
†Joel William Cline	Newton
*Brian Scott Collie	Riedsville
Jenny Alice Condrey	Dunn
**James Richard Cook	Sonoma, CA
***Kyle Corbin	Raleigh
***David Eugene Cox	Greensboro
Jeffery Lake Crume	Raleigh
*Gregory Franklin Dail	Wilson
**Ru-Ming Ko Duh	Taipei, Taiwan
Kenneth Michael Edwards	Norwood
*Sarah Hall Gardo	Seaford, VA
***David Glenn George	Raleigh
***Bruce Richard Green	Wilmington
Richard Scott Green	Ronda
Bruce Kevin Hardman	Cary
*Michael Paul Hecht	Newport
Brent Varney Hill	Winston-Salem
Grady Wayne Hill	Clayton
Karen Lynn Hoffman	Raleigh
Richard Christopher Hopkins, Jr.	Williston
Wayne Lee Horton	Raleigh
Kushay Fiechen Yeoh How	Kuala Lumpur, Malaysia
Larry Mark Kennedy	Sparta
†Christopher Dale La Brie	Leland
Jeffrey Clarke Layman	Durham
Mark Allen Lindsay	Hickory
Todd Norton Lloyd	Asheville
David Anthony Marsico	Cary

Charles Stephen McBride	Winston-Salem
**Patricia Karen McDuffie	Charlotte
Gerald Edmond Meetze	Matthews
Dennis Clark Milam	Asheville
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†Robert Alton O'Neal	Eden
Michael Seward Peters	Cary
Michael Wade Pierce	Wilmington
Jeffrey Aaron Polzin	Marietta, GA
Thomas Eugene Potok	Cary
*Bennie Eugene Reeves, Jr.	Virginia Beach, VA
Donald Eugene Ritter	Raleigh
George Daniel Robertson	Eden
Eric Michael Roeder	Raleigh
Andria Michelle Ross	Lincolnton
***Sherri Ann Saunders	Graham
*Thomas Ward Scheviak	Asheville
William Mark Shellman	Gastonia
Yves Peter Philip Simons	Mol, Belgium
*Dawn Marie Skelly	Wilmington, DE
Joseph George Slater	Raleigh
Sharon Denise Smith	Wendell
Robert Allen Souther	Hamptonville
Joseph Kirkman Transou	Lewisville
***Charles Knox Wallis	Morganton
Harold Louis Weinbrecht, Jr.	Raleigh
Cynthia Marie Wellons	Wallace
William Stokes Wells, III	Rose Hill
Randal Keith Whitehead	Raleigh
Randy Scott Willard	Winston-Salem
Mark Dewart Williams	Raleigh
***Carol Elizabeth Wyke	Charlotte
***Kathryn Ann Wyke	Charlotte
Andrea Syrilla Young	Warrenton
Thomas William Zack	Raleigh

BACHELOR OF ARTS IN GEOLOGY

Degree Conferred December 20, 1983

Clay Charles Murray	Miami, FL
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Degrees Conferred May 12, 1984

Daryl Darnell Clark	Wilmington
Bruce Everette Lefler, Jr.	New London

BACHELOR OF SCIENCE IN GEOLOGY

Degrees Conferred August 10, 1983

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Ellen Brayer Lorscheider	Raleigh
Kenneth Randall Prillaman	Martinsville, VA

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Gene David Garrett	Valdese
Erik Harold Hagen	Kings Mountain

David Carter Keith	Winston-Salem
Roger Daniel Moore	Cary
Allan Kaare Stokke	Oslo, Norway
Thomas Robert Will	Chagrin Falls, OH

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Andrea Jane Lord	Augusta, ME
James Robert Wells, Jr.	Gastonia

BACHELOR OF SCIENCE IN MATHEMATICS

Degree Conferred June 29, 1983

Carl Gray Kearney	Pfafftown
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Degree Conferred August 10, 1983

John Dowd Elliott, Jr.	Fuquay-Varina
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Christopher Allen Cantwell	Winston-Salem
†Karen Kay Fleischer	Port Allegany, PA
Robin Glenna Phillips	Durham
Marcelle Benrimokh Thomas	Raleigh

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Richard Nguyen Banh	Carrboro
†Andrew Eppard Barnett	Raleigh
H**Dale Edward Boger	Clemmons
**William Frank Chambers	Clyde
***Carolynn Alison Cyszcz	Greensboro
Susan Lynnette Davis	Raleigh
*Dewey Dill Dellinger	Lincolnton
**Robin Renee Fletcher	High Point
David Lee Foster	Rutherfordton
**Rose Lee Hall	Raleigh
*Deborah Denise Hill	Jacksonville
Pauline Elizabeth Hine	Charlotte
Stephen Alan Jasper	Raleigh
**Jill Newton	Greenville, SC
Lisa Marie Seward	Lumberton

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Degrees Conferred June 29, 1983

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Donald Ray Cahoon, Jr.	Creedmoor
Timothy Scott Cutler	Vanceboro

Degree Conferred December 20, 1983

Allan Richard Van Meter	King
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Degrees Conferred May 12, 1984

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†Joel William Cline	Newton
Jo Friedrich	Parkston, SD
Paul McGehee Lewis, II	Reidsville
William Henry Ligon, Jr.	Dunwoody, GA
Eddie Carlton Matthews	Sanford
***Donald Theodore Olerud, Jr.	Hamlet
Thomas Michael Tasselmyer	Raleigh
Thomas Joseph Whitehair	Wallingford, VT
Josephine Gail Whitley	Washington

BACHELOR OF SCIENCE IN PHYSICS

Degree Conferred August 10, 1983

**Richard Alan Eichinger	Cary
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Degrees Conferred May 12, 1984

†***James Williams Bales	New London
H***Paul Alan Carter	Eden
Millard Franklin Morgan, III	Bailey
**David McWhorter Pierce	Raleigh
Joseph Michael Stock	Hickory

BACHELOR OF SCIENCE IN STATISTICS

Degree Conferred August 10, 1983

Robert Lee Tucker	Cooleemee
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Degree Conferred December 20, 1983

Kurt Alan Jetta	West Chester, PA
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Degree Conferred May 12, 1984

Michael George Lasher	Charlotte
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School of Textiles



BACHELOR OF SCIENCE IN TEXTILE CHEMISTRY

Degrees Conferred June 29, 1983

Marty Rudolph Bullins	Danbury
Ernest Michael Mueller	Hamilton, Ontario

Degrees Conferred August 10, 1983

†H**Pinank Rajanikant Mehta	Ahmadabad, India
**Cynthia Sweezy Williard	Hickory

Degrees Conferred December 20, 1983

***Penny Jo Bruce	Charlotte
Douglas Alan Bynum	Alexis
Elizabeth Faye Chouquette	Asheville
*Christopher Hamilton Gardner	Concord
Christopher Conrad Johnson	Fayetteville
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William Nathan Mullinix, III	Albemarle
Timothy Winfield Towell	Towaco, NJ

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H*Rachel Watson Boyette	Lucama
D. Mark Dunham	Linden
William Nathan Easterling	Fayetteville
*Donald Elwood Edwards	Barren Springs, VA
Mark Ira Farbman	Charlotte
†Jeffrey Neal Johnson	Greensboro
†Brenda Leigh Kelly	Garner
Angela Ruth Millirons	Winston-Salem
†**Gregory Alan Mills	Oakboro
*Roger Gann Page	Yanceyville
*Christopher Charles Randall	Lawndale
Edgar Lamar Self, II	Gastonia
Roger Harold Sisson	Winsted, CT
Mary Elizabeth Smith	Mt. Gilead
Stanley Arnold White	Pine Level

BACHELOR OF SCIENCE IN TEXTILE MANAGEMENT

Degree Conferred June 29, 1983

Dexter Raymond Barbee, Jr.	Burlington
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Degrees Conferred August 10, 1983

Corey Dana Bousquet	Gastonia
James Ernest Campbell	Dunn
Steve Gus Kondilis	Asheville
Todd Alan Musick	Wrightsville Beach

Degrees Conferred December 20, 1983

Mark Harold Adair	Forest City
Mary Anne Bedwell	New Bern
Steven Harold Biggerstaff	Maiden
*Lisa Shea Cox	Monroe
Curtis Desmond Foushee, Jr.	Burlington
Eric Todd Haley	Kannapolis
*Stephen Edward Jenkins	Bunn
Karl Dewayne Kelly	Salisbury
Derrick Eugene Kirkman	Climax
Colon Ray Knight	Burlington

† Co-major * Cum Laude ** Magna Cum Laude *** Summa Cum Laude H Honors Program

Jeffrey Bernard Mack	Wilmington
**Lukas Michel	Ziegelbruecke, Switzerland
Richard Norman Odden	Raleigh
**Shane Grayson Phillips	Rockingham
David Enrique Sasso	Thomasville
James Ricky Sherrill	Forest City
**Robert Wilson Stanford	Greensboro
Jackie Wayne Threatt	Polkton

Degrees Conferred May 12, 1984

David Kevin Adkins	Harrisburg
Abraham John Beucus, V	Morganton
Charles Lee Collier	Spartanburg, SC
Elmer Ross Crews, Jr.	Roxboro
Teddi Lynette Essick	Winston-Salem
Scott Bruce Fennie	Ridgewood, NJ
H***Susan Gaynelle Gossett	High Point
John Nathan Gregg, Jr.	Wayne, PA
Larry Nelson Grogan	Winston-Salem
Lisa Kaye Hall	Walnut Cove
*Bessie Lee Howard	Clayton
Nicholas Dean Lee	Mt. Olive
Leigh Ann Rose Moore	Salisbury
Peter Reid Sigmon	Newton
Richard William Skibo	Shelby
***Mark Lee Starnes	Shelby
David Michael Strader	Thomasville
James Francis Valentine, Jr.	Raleigh

BACHELOR OF SCIENCE IN TEXTILE SCIENCE

Degree Conferred December 20, 1983

James Greene Saunders	Charlotte
-----------------------------	-----------

Degrees Conferred May 12, 1984

**Debra Ann Bernard	Winston-Salem
*Adrián Edgardo Birenchwajg	Buenos Aires, Argentina
**Judson Wade Carter	Raleigh

BACHELOR OF SCIENCE IN TEXTILES

Degree Conferred August 10, 1983

Sharon Dawn Holt	Troy
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Degrees Conferred December 20, 1983

Patricia Carol Griffin	Monroe
Lindley Edward Jones	Graham
***Suzanne Denise Kearns	Durham
Jannette Perry	Greenville
Gwendolyn Denise Price	Whiteville
Teresa Reid	Fayetteville
Yvonne Renee Scott	Lenoir

Degrees Conferred May 12, 1984

H*	Connie Elaine Britt	Goldsboro
	Nancy Jane Campbell	Roanoke, VA
	Debbie Cho	Raleigh
	Roberto Mitri Gharzouzi	Guatemala City, Guatemala
	Jennifer Leigh Hair	Fayetteville
	Anne Catherine Horne	Charlotte
**	Monika Laumann	St. Catharines, Ontario
	George Edward Manuel, Jr.	Thomasville
	Carolyn Elizabeth Wilson	Mebane
**	Betty Kathleen Wylie	Wilson

† Co-major

* Cum Laude

** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

Professional Degrees



BACHELOR OF ARCHITECTURE

Degrees Conferred June 29, 1983

Bobby Steven Auman	Jamestown
John David Montgomery	Asheboro

Degree Conferred August 10, 1983

Donald Odell Tise, Jr.	Greensboro
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Degree Conferred December 20, 1983

Steven Allen Key	Raleigh
------------------------	---------

Degrees Conferred May 12, 1984

Chris Eugene Brasier	Vinita, OK
Cynthia Jane Cline	Asheville
Steven William Cofer	Jacksonville
Michael Charles Conley	Ponte Vedra, FL
Junius Summerfield Grimes, IV	Raleigh
Raymond Gordon Hunt	High Point
Timothy Carl Johnson	N. Scituate, MA
Craig Dale Leonard	Hillsborough
Harry Nicholas Mackie	Boston, MA
Todd Wilson Neal	Raleigh
Alice Talmage Robinson	Raleigh
William Carl Shaffer	Raleigh
DeVon Lewis Tolson	Pinetops
Harry Edward Wyatt, Jr.	Durham

CIVIL ENGINEER

Degree Conferred June 29, 1983

Marisela Haack	Caracas, Venezuela
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NUCLEAR ENGINEER

Degree Conferred December 20, 1983

Arevalo Abraham Ortega	Columbia, MD
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† Co-major

* Cum Laude

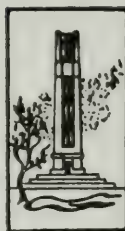
** Magna Cum Laude

*** Summa Cum Laude

H Honors Program

GRADUATE DEGREES

Master's Degrees



MASTER OF AGRICULTURE

Degrees Conferred August 10, 1983

William Connelly Ellers	Wagram
Jan Ellen Freedman	Lafayette, LA
Freddie Ellis O'Neal	Trenton

Degrees Conferred December 20, 1983

William Hunter Edwards	Stokes
Bruce Allen Emmons	Memphis, TN
Mary Pamela Owens	Burlington
James Russell Sikes	Rockingham

Degrees Conferred May 12, 1984

John Vann Hall	Sanford
Talmadge Jeffrey Parris	Candler
Jerry Bryant Washington	Sparta

MASTER OF ARCHITECTURE

Degrees Conferred December 20, 1983

Louis Walter Cherry	Grifton
Mete Salih Gurel	Istanbul, Turkey
Rebecca Ann Harrison Mentz	Lexington, KY
Paul Daniel Regan	Raleigh
Kim Michele Tanzer	Raleigh

Degrees Conferred May 12, 1984

Steven Earl Gaddis	Durham
Ten Ren Terry Hsu	Taipei, Taiwan, Republic of China
Frank Lewis Irete	Charlotte
Sergio Ortiz Jimenez	Guadalajara, Mexico
Leslie Annette Johnson	Louisville, KY
Peter Lorentz Lassen	Santa Barbara, CA
Raymond Eugene Peloquin	Washington, DC
Chainarong Ratanacharoensi	Bangkok, Thailand
Mark Allen Sever	Miami, FL
Kevin Brian Utsey	Wilmington
Donna Jean Ward	Efland
Fu-Shin Yen	Taipei, Taiwan, Republic of China

MASTER OF BIOMATHEMATICS

Degree Conferred May 12, 1984

Stephen Weller	Cary
----------------------	------

MASTER OF CHEMICAL ENGINEERING

Degrees Conferred August 10, 1983

Mona Wassef Gabriel	Raleigh
Iain Mair McKenzie	Aberdeen, Scotland
Douglas Stuart Thompson	Richmond, CA

MASTER OF CIVIL ENGINEERING

Degrees Conferred August 10, 1983

Ishwar Chandra Devkota	Kathmandu, Nepal
Larry Warren Elkins	Princeton, WV
Mohammad Hossein Kajbaf	Tehran, Iran

Degrees Conferred December 20, 1982

Lebeed Yousif Al Kadhi	Baghdad, Iraq
Shailesh Subramanya Bettadapur	Fredericksburg, VA
Chwen-Jinq Chen	Taipei, Taiwan, Republic of China
Thomas Edward Markiewicz	Bristol, CT
Gregory Russell Perfetti	Cortland, NY
Raymond Austin Pittman	Sumter, SC
Gregory Alan Robinson	Raleigh
Ronald Ray Sewell	Roanoke Rapids
Chang-Wei Wang	Keelung, Taiwan, Republic of China

Degrees Conferred May 12, 1984

Hashem Musaed Altabtabai	Kuwait, Kuwait
Elham Farzam	Stamford, CT
Keith Donald Lewis	Raleigh
Nancy Montiel	Raleigh
Barbara Hill Mulkey	Charlotte
Shawn Patrick Sculley	Hampton, VA
Thomas Sharrock Speight, Jr.	Williamston
Eric Kellum Svendsen	Jacksonville

MASTER OF COMPUTER STUDIES

Degrees Conferred August 10, 1983

Sharri Russell Barker	Kansas City, MO
Ja-Song Leu	Yun-Lin, Taiwan, Republic of China
Kou-Ching Jessica Wang	San Jose, CA

Degrees Conferred December 20, 1983

Reine Aline Chimiak	Cary
Jialin Hwang	Taipei, Taiwan, Republic of China
Guangcha Liao	Taipei, Taiwan, Republic of China

Degrees Conferred May 12, 1984

Kathryn Edwards Clarke	Grifton
Yashowardhan Gupta	Raleigh
Mary Ann Hebbardt	Raleigh
Keepak Madhukar Karmarkar	Bombay, India
Jungsoon Park Yoo	Seoul, Korea

MASTER OF ECONOMICS

Degrees Conferred August 10, 1983

Sharon E. Herb Bell	Oak Ridge, TN
Theresa Smith Spencer	Cary

Degrees Conferred December 20, 1983

Robyn Cohen Carpenter	Sanford
Danny Paul Evans	Garner
Lilyan Estela Fulginiti	Resistencia, Argentina
Jerry Lewis King	Roanoke, VA
Tulin Gaglar Koray	Istanbul, Turkey
Jeffrey Lynn Moretz	Hickory
Jeffrey Alan Payne	Elkin
Evan Thomas Rees	Greensboro
Sudha Rani Singh	Annandale, VA
Luis Francisco Zaldivar	Santa Tecla, El Salvador
Patricia Bettaglio de Zaldivar	El Salvador, El Salvador

Degrees Conferred May 12, 1984

John Martin Atkins	Sanford
Mary Lee Brooks	Raleigh
Sandra Jo Curtis-Powell	Raleigh
Roger Lewis Debo	West Chicago, IL
Katherine Louise Foote	Raleigh
Mary Rawlinson Haywood	Durham
Jae-Ok Lee	Seoul, Korea
Lutuf Farouk Quaddoumi	Nablus, Palestine
Stephan Michael Stanley	Fayetteville

MASTER OF EDUCATION

Adult and Community College Education

Degrees Conferred August 10, 1983

Lori Denise Bryan	Raleigh
Betty Arp Green	Hope Mills
Kathleen Butler Heath	Clinton
Jennings Penney Oliver	Wallace

Degrees Conferred December 20, 1983

Romine David Bristol	Germantown, TN
Anne Edge Dale	Engelhard
Claudia Huey Hughes	Raleigh
Mohamed Zin Jantan	Kuala Lumpur, Malaysia
Eugene Louis Perrotta	Raleigh
Sharon Patricia Thompson	Edenton

Degrees Conferred May 12, 1984

George Raz Autry III	Lumber Bridge
Donald Williams Baker	Elizabeth City
Peggy McCall Casey	Burgaw
John William Dunham	White Oak
Elaine Heffner Gosnell	Horse Shoe
Tracy Karl Hardison	Cameron
Ann Terrill Johnson	Greensboro
Sandra Johnson	Rex
Ingrid Hardison Redmond	Spring Lake
Katherine Bain Taylor	Elizabethtown

Agricultural Education

Degree Conferred August 10, 1983

Raymond Neil Caviness	Siler City
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Degrees Conferred December 20, 1983

Thomas Gregory Fisher	Laurens, SC
Roy Lane Gregory	Angier
John David Jenkins, Jr.	Robersonville

Degrees Conferred May 12, 1984

Gregory Hugh Danford	Bladenboro
Caroline Huntley Pearson-Mims	Raleigh

Curriculum and Instruction

Degrees Conferred August 10, 1983

Jennie Ann Johnson Franklin	Warrenton
Frances Stenwick Grady	Durham
Thomas Bernard Hawkins	Raleigh
Teresa H. Mozingo	Goldsboro

Degrees Conferred December 20, 1983

Gurley Morrison Casper, Jr.	Hillsborough
Mary Jeanette Rohrbach	Raleigh

Degrees Conferred May 12, 1984

Judith Almes Armstrong	Englewood, OH
Donna Marie Bagwell	Raleigh
Mary Ann Benson Bennett	Creedmoor
Catherine Bynum Clements	Raleigh
Jane Bryson Harris	Shelby
Faith Marie Kelley	Raleigh
Sammy Penny Overby	Fuquay-Varina
Carolyn McKay Penny	Elizabeth City
Vicki Sykes Phelps	Louisburg
Grace Ann Staton	Raleigh
Cathy Edwards Yancey	Wendell

Educational Administration and Supervision

Degrees Conferred August 10, 1983

Deborah Lee Floyd	Durham
Edward Perry Gainor	Raleigh

Degree Conferred December 20, 1983

Christie A. Holcomb	Winston-Salem
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Guidance and Personnel Services

Degrees Conferred August 10, 1983

Catherine Jo Coleman	Raleigh
Anne Mickle Huffman	Burlington
Susan Bebon Schmidt	Cary
Frank Paige Scott, Jr.	Oxford

Degrees Conferred December 20, 1983

Madra Nelson Britt	Cary
Beverly Janelle Duncan	Raleigh
Frederick Douglas McEachern	Garner
Donna Jeanene Rose	Littleton
Jane Elizabeth Smith	Durham

Degrees Conferred May 12, 1984

Sara Busey Anderson	Cary
Kimberly Futrelle Crews	Raleigh
Bessie Jane Ebron	Robersonville
Anne Hodges Feagin	Hendersonville
Reginald Fennell	Goldsboro
Sarah Anne Harmer	Raleigh
Emily Insley Holmes	Edenton
Cynthia Rose Hood	Benson
Julie Camille Jones	Raleigh
Deborah Sheletta Matthews	Raleigh
Jane-Elizabeth Mosher	Raleigh
Erdmuth Dorothea Venable	Raleigh
Judy Lynn Woodson	Raleigh
Michiko Sakai Yasui	Tokyo, Japan

Industrial Arts Education

Degree Conferred August 10, 1983

Gayenell Campbell Gull	Apex
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Degrees Conferred December 20, 1983

Elazer James Barnette	Cramerton
Alice Young Scales	Raleigh

Degrees Conferred May 12, 1984

Cynthia Lea Pearsall	Fayetteville
Mitchell Brinkley Puryear	Raleigh

Mathematics Education

Degree Conferred August 10, 1983

James Allen Walters	Barboursville, WV
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Degree Conferred December 20, 1983

Sambra Jane Pittard	Oxford
---------------------------	--------

Degrees Conferred May 12, 1984

Camille Fay Bishop	Wilmington
James Everette Martin	Graham
Martin R. Waite	Redcar, England

Occupational Education

Degrees Conferred August 10, 1983

Lequita Joy Ussery Frankoff	Albemarle
Robbie Thomas Rogers	Fuquay-Varina

Degrees Conferred May 12, 1984

Everett Joseph Nunes	Elizabeth City
Nancy Langley Raynor	Raleigh
Duane Alan Rominger	Chapel Hill
Jean Hurst Williams	Apex

Science Education

Degree Conferred August 10, 1983

Cameron Beckwith Srpan	Cary
------------------------------	------

Degree Conferred December 20, 1983

Virginia Ruth OwensCary

Degrees Conferred May 12, 1984

Linda Shoffner IsleyRaleigh
Jeanette Richards SavantRaleigh
Judith Ennis SmithAngier

Special Education**Degrees Conferred August 10, 1983**

Janet Pittman GodboldCary
Robyn Debra JonasHuntington, NY
Karen Truesdell RodenhizerDurham
Margaret Seymour St. JohnGoldsboro
Shauna Butler SaundersDurham

Degrees Conferred December 20, 1983

Shirley Buchan BlanksRaleigh
Reba Calloway BowmanSanford
Annette Janine GeorgeColumbus, IN
Nancy Manning JohnstonCary
Ritchie F. LilesNew Orleans, LA

Degrees Conferred May 12, 1984

Linda McCain BurrowsRaleigh
Cynthia Malin CoxRaleigh
Cara Mia DancyRaleigh
Miriam Elizabeth DixonChapel Hill
Pamela Wines EdwardsRichmond, VA
Linda Rogers HylerRaleigh
Nancy Ruth NewellRaleigh
Katie Durham TooleRaleigh
Peter G. Van GiesonRaleigh
Marian Lytle WootenRaleigh

Vocational Industrial Education**Degrees Conferred May 12, 1984**

Richard Aubrey FryBeulaville
Samuel SolomonLouisburg

MASTER OF FORESTRY**Degrees Conferred May 12, 1984**

Peter David SchroederOttawa, OH
Christina Louise van DorstenRochester, NY

MASTER OF INDUSTRIAL ENGINEERING**Degree Conferred December 20, 1983**

Haw ShihTaichung, Taiwan, Republic of China

MASTER OF LANDSCAPE ARCHITECTURE**Degree Conferred August 10, 1983**

David Theodore SwansonRaleigh

Degrees Conferred December 20, 1983

Dorothy Midyette Barnes	Raleigh
Douglas Herbert Bethune	Charlotte
Eugene Richard Bolinger	North Attleboro, MA
Lisa Britt Dodd	Spring, TX
Mamie Burnam Pastore	Raleigh
Surapon Sujjavanich	Bangkok, Thailand

Degrees Conferred May 12, 1984

Ghassan A. Saleh Al Ghassan	Manama, Bahrain
Harriet Bellerjeau	Brandon, VT
Bruce Alan Clodfelter	High Point
Harold Gene Keever, Jr.	Beaverton, OR
Robert Walsh Moore, Jr.	Franklin
Jane Marie Norton	Staten Island, NY
Roger Eugene Sauerborn	Baltimore, MD
John Duncan Taylor	Darien, CT
James E. Thiem III	Raleigh
Norma Blackburn White	Hillsborough

MASTER OF LIFE SCIENCES

Degrees Conferred August 10, 1983

Maureen Cullen	New York, NY
Douglas Brownell Hansen	Raleigh

Degrees Conferred December 20, 1983

Sherman Nelson Alfors	Greenville
Melissa Vail Lawson	McLean, VA
Sharon Roberta Manning	Charleston, SC

Degrees Conferred May 12, 1984

Manju Agarwal	Calcutta, India
Zigrida Liepkalne Smith	Raleigh

MASTER OF MATERIALS ENGINEERING

Degrees Conferred December 20, 1983

Kyoo-Sik Bae	Seoul, Korea
John Joseph Moore	Statesville

Degrees Conferred May 12, 1984

James Dennis Cox	Raleigh
Lawrence Delwood Ray	Fayetteville

MASTER OF MECHANICAL ENGINEERING

Degrees Conferred August 10, 1983

Chi-Min Chang	Feng-Yuan, Taiwan, Republic of China
Edwin Blodgett Hoffman	Wilmington, DE
Michael John Kinney	Cary
Michael Assaad Lahoud	Raleigh

Degrees Conferred December 20, 1983

Elaine Joyce Holden	Littleton
Ta-Chung Hsia	Taipei, Taiwan, Republic of China
Ahmad Yousuf Kalendar	Shmiya, Kuwait
William Meserve Lane	Charlotte
T'zong-Kuan Lin	Taipei, Taiwan, Republic of China

Woe-Chul Park	Kimhae, Kyungnam, Korea
Daniel Philip Popok	Morehead City
Farid Sadeghi	Tehran, Iran
Nae-Ming Shiau	Ping Tung, Taiwan, Republic of China

Degrees Conferred May 12, 1984

Mendel Berko	Haifa, Israel
Kuo-Raid Grant Chen	Taipei, Taiwan, Republic of China
William Edward Cogburn	Chapel Hill
Charles Henry Dow	Kinston
Frederick Paul Fendt	Durham
Celaleddin Gokcek	Istanbul, Turkey
William Mark Hardesty	Cullowhee
Farzad Kavooosi	Cary
Jin-Chang Lee	Taichung, Taiwan, Republic of China
Fue-Wen Liou	Miaoli, Taiwan, Republic of China
Chi-Kai Lo	Tainan, Taiwan, Republic of China
Danning Ma	Zhejiang, People's Republic of China
Michael Craig Riley	Greenville, SC
Mary Clare Robbins	Huntersville
Shyi-Hwang Shyu	Taipei, Taiwan, Republic of China
Yong-Sun Wie	Seoul, Korea
Henly Wu	Taipei, Taiwan, Republic of China

MASTER OF NUCLEAR ENGINEERING

Degree Conferred August 10, 1983

William Pearson Evans	Bethesda, MD
-----------------------------	--------------

Degrees Conferred May 12, 1984

Pei Yeou Li	Taichung, Taiwan, Republic of China
-------------------	-------------------------------------

MASTER OF PRODUCT DESIGN

Degrees Conferred December 20, 1983

David Schoch Chapin	Raleigh
Warren Bailey McCollum	Durham
Wallace Craig McLawhorn	Wrightsville Beach
John Gregory Sell	Raleigh

Degrees Conferred May 12, 1984

Arlene Aycock Biles	Raleigh
Donald Lee Branch	Erie, PA
Lisa Marylouise Creed	Surry, ME
Charles Leland Floyd	Spencer
Neil Jonathan Goldberg	Cape Town, South Africa
Brenda Joyce Smith	Durham
Margie Ann Stewart	Durham

MASTER OF PUBLIC AFFAIRS

Degrees Conferred August 10, 1983

Lawrence Barrett Burwell	Greensboro
Karen Ann Cafferty	Raleigh
Salman Husain	Raleigh
Lynda Dale McDaniel	Raleigh
Tanya Benita Prunty	Bronx, NY
Caterina Sanchez	Fayetteville
Russell Irvin Tarver	Raleigh
Gwendolyn Wade	Enfield

Degrees Conferred December 20, 1983

Robert Lee Burns	Cary
Garlinda Carmelita Carroll	Enfield
Jacqueline Faye Clark	Raleigh
Michelle Veronica Dean	Winston-Salem
Douglas Brian Galke	Blowing Rock
Vera Delores Greene	Raleigh
Sherri Baird Harper	Raleigh
Cora Susan Hopson-Evans	Johnson City, TN
Robert Henry Meek	Washington
Camille Fleming Rogers	Creedmoor
Sandra Gills Rothschild	North Redington Beach, FL
Donald Ray Tanner	Raleigh
Ray Stanford Williams, Jr.	Raleigh

Degrees Conferred May 12, 1984

William Everett Brown	Raleigh
Robin Bliss Capps	Raleigh
James William Fuller	Raleigh
Louise Parrish Lockwood	Asheville
George Wesley McCullen	Raleigh
Mark Arrington Perry	Raleigh
Annie Frank Pickard	Raleigh
Ervin Timothy Thompson	Salisbury

MASTER OF RECREATION RESOURCES

Degrees Conferred August 10, 1983

Mark James Hendrickson	Greenwood, SC
June Claire Landry	White Castle, LA

Degree Conferred December 20, 1983

Edmund McCaffray III	Baltimore, MD
----------------------------	---------------

Degrees Conferred May 12, 1984

John Robert Byrd	Durham
Victoria Ann Emblar	Guilderland, NY
Victor Conrad Garber	Harrisonburg, VA
Gene Keith Gurganus	Wilson
Brenda Elizabeth Lewis	Cary
Michael Roger Warren	Raleigh

MASTER OF SOCIOLOGY

Degree Conferred August 10, 1983

Billy Earl Privette	Mullins, SC
---------------------------	-------------

MASTER OF STATISTICS

Degree Conferred August 10, 1983

Tswei-Fen Connie Liu Yuan	Taipei, Taiwan, Republic of China
---------------------------------	-----------------------------------

Degrees Conferred December 20, 1983

Julius Odirichukwu Asogu	Owu-Amakohia, Nigeria
Donna Overman Fulenwider	Stantonsburg
Gail Meredith Knowlton	Raleigh
Mark Christopher Otto	Bynum

Degrees Conferred May 12, 1984

Marie del Piler Ester Arroyo-GaytanToluca, Mexico
Daniel Arturo Ballado-Perez Veracruz, Mexico
Richard Wayne Morris Raleigh

MASTER OF TECHNOLOGY FOR INTERNATIONAL DEVELOPMENT

Degree Conferred December 20, 1983

Terence Doherty Fayetteville

Degree Conferred May 12, 1984

Thomas Patrick Norman Raleigh

MASTER OF TEXTILES

Degrees Conferred December 20, 1983

Thomas Bruno BollerTurbenthal, Switzerland
Alma Meliser CorbettBurlington
Linda Joan Martin New Britain, CT

Degrees Conferred May 12, 1984

Bin Muhammad Jamaluddin Raub, Malaysia
Hong Peng Shanghai, People's Republic of China
Susan Marie PoitrasNew Bedford, MA

MASTER OF TOXICOLOGY

Degree Conferred December 20, 1983

Darrell Glenn Coston Wilmington

MASTER OF WOOD AND PAPER SCIENCE

Degree Conferred August 10, 1983

William Jarrett Biggers Raleigh

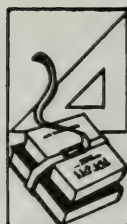
Degrees Conferred December 20, 1983

William Swope Bryan Louisville, KY
William Conrad Wyatt, Jr. Millers Creek

Degree Conferred May 12, 1984

Ashari Abdul Jalil Melaka, Malaysia

Master of Arts Degrees



Economics

Degrees Conferred August 10, 1983

Resa Rae Snellen	Raleigh
Lee Ann Sullivan	Spencerport, NY

Degree Conferred May 12, 1984

Charles Thomas Joyner	Raleigh
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English

Degrees Conferred August 10, 1983

George Lawrence Allen	Cameron
Daphne Hamm O'Brien	Raleigh
Bobby Glen Ruth	Raleigh
Michael Wingfield Schaefer	Chapel Hill

Degrees Conferred December 20, 1983

Martha Jennette Banks	Washington
Alfred Robert Kraemer	Raleigh
Jana Maria McCallum	Candor
Beryl Cox Pittman	Raleigh
Marcia Lynn Retchin	Wilmington
Karen Suzanne Rose	Winston-Salem
Lisa Nanney Schaefer	Chapel Hill

Degrees Conferred May 12, 1984

Rose Christian Wooten Allen	Cameron
Robin Ann Bailey	Raleigh
Sheryl Jasielum Helfer	Springfield, PA
Mary McBryde Mintz	Hallsboro

History

Degree Conferred August 10, 1983

Russell Eugene Dowdy	Sanford
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Degree Conferred May 12, 1984

Christopher Edward Allen	Raleigh
--------------------------------	---------

Master of Science Degrees



Adult and Community College Education

Degree Conferred August 10, 1983

Samsudin Saud Kuala Lumpur, Malaysia

Agricultural Economics

Degree Conferred August 10, 1983

Kirsten Ruth OlsonCarbondale, IL

Degree Conferred December 20, 1983

Uma RamakrishnanMadras, India

Degrees Conferred May 12, 1984

John Christopher Beghin Brussels, Belgium

Jaime Alberto Beron Cali, Colombia

Jaime Jose Salinas Tegucigalpa, Honduras

Animal Science

Degrees Conferred December 20, 1983

Donna Marie Amaral Oneco, CT

Carl Ray McKnight China Grove

Scott Reece Starnes Waxhaw

Agricultural Education

Degree Conferred May 12, 1984

Ricky Earl Joyner Mount Olive

Biochemistry

Degree Conferred August 10, 1983

Philip Terrell Weinbrecht Raleigh

Degree Conferred December 20, 1983

Michael John Beggs Pittsburgh, PA

Biological and Agricultural Engineering

Degree Conferred August 10, 1983

Matthew Clay Smith DeLand, FL

Degrees Conferred December 20, 1983

Mark Bernard Chamblee Zebulon

Timothy Lee Foutz Ahoskie

Degrees Conferred May 12, 1984

Lynne Alexander	Rochester, NY
George Maynard Chescheir III	Louisville, KY

Botany

Degrees Conferred August 10, 1983

Willy Kalt-Torres	Gibson
*Sarah Margaret Nusser	Iowa City, IA

Degree Conferred December 20, 1983

Christina Nichols Harvey	Raleigh
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Degrees Conferred May 12, 1984

Lois Margaret Anderson	Chapel Hill
Barry Reese Dalton	Mocksville
Roger Lane Pearce	Rocky Mount

Chemical Engineering

Degrees Conferred August 10, 1983

Barry Smith Fagg	Kernersville
Francis Davidson Gilman III	Matthews

Degrees Conferred December 20, 1983

Haitham Al-Hussaini	Ahmadi, Kuwait
Theodore Duke Duncan	Charlotte
George Terry Hamrick	Shelby
Nancy Ellen Krohn	Pensacola, FL
Thomas Michael Miller	West Jefferson
David Lee Sorrells	Arden
James Stephen Staton	Charlotte

Degrees Conferred May 12, 1984

Chung-Hoo Chao	Raleigh
Kai Cheung Chin	Hong Kong
Martha Wilson Girolami	Memphis, TN
Lewis Raymond Iler	Raleigh
Jacob Joseph Orbon, Jr.	Raleigh
Tracy Scott Rudisill	Dallas
Karen Lee Rutledge	Pensacola, FL
Paykan Safemazandarani	Tehran, Iran
William Donald Scott, Jr.	Greensboro
Afsaneh Zand	Tehran, Iran

Chemistry

Degrees Conferred May 12, 1984

Michael Anthony Nemzek	Charlotte
Angelita Samson Ng	Manila, Philippines

Civil Engineering

Degrees Conferred August 10, 1983

Ta-Liang Hsu	Taichung, Taiwan, Republic of China
Sang-Ho Lee	Seoul, Korea

* Co-major in Statistics. See page 91.

Degrees Conferred December 20, 1983

Chao-Hsun Boris Chen	Taipei, Taiwan, Republic of China
Edmund Nicholas Chrzanowski	Cleveland, OH
Sitaram Venkata Josyula	Madras, India
James Bedford Phillips	Fayetteville
Ye-ren Wang	Taipei, Taiwan, Republic of China

Degrees Conferred May 12, 1984

Cecep Nazaruddin Aziz	Jakarta, Indonesia
Mingtian Chang	Taichung, Taiwan, Republic of China
Joong Sun Choi	Seoul, Korea
Keith Saint Clair Duncan	Fayetteville
Lucy Ann Gebhart	Centerville, TN
Hsin-I Lee	Taipei, Taiwan, Republic of China
Willy Edward Stewart	Durham
Lei Sun	Tainan, Taiwan, Republic of China

Computer Studies

Degrees Conferred August 10, 1983

Sunil Vasudeo Ashtaputre	Bombay, India
Karen Ann Dassel	Evansville, IN
George Varghese	Bombay, India

Degrees Conferred December 20, 1983

David Gray Boyer	Camp Hill, PA
Kenneth Perry Garrard	Durham
Margaret Honeycutt Groves	Wilmington
Pierre Jacques Lavency	Namur, Belgium
Hiran Josvel Marques	Sao Paulo, Brazil

Degree Conferred May 12, 1984

Alison Diana Naylor	Raleigh
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Crop Science

Degrees Conferred August 10, 1983

John Lawrence Neal	Durham
William Beaurie Parker	Gates

Degrees Conferred December 20, 1983

John Martin de Ruiter	Raleigh
Dwight Starnes Fisher	Charlotte
Frank Michael Godley	Bath
Randall Newton Holley	Miami, FL
Rex Allan Liebl	Raleigh
Lambert Blanchard McCarty	Batesburg, SC

Degrees Conferred May 12, 1984

Sharlie Eleanor Larson	Valle Crucis
Thomas Charles Mester	Coleman, MI
Ronald Sylvester Monk	Warsaw
John Lincoln Spilsbury	Norwich, NY

Electrical Engineering

Degrees Conferred August 10, 1983

Thomas Michael Bradicich	Boca Raton, FL
Jen-Sheng Chen	Tainan, Taiwan, Republic of China
Charles Eric Diener	Cary
Chung-Hsing Fan	Taipei, Taiwan, Republic of China
Joseph Georges Hatem	Hammana, Lebanon
Norman Bin Mariun	Taiping, Perak, Malaysia
Neal Stephen Page	McLean, VA
James Thomas Parker	Greensboro
Piyushkumar Natvarlal Sura	Birpur, Gujarat, India
John Joseph Szarek	Cary
Roger Mack Vines	Raleigh
David Bryan Wilson	Raleigh

Degrees Conferred December 20, 1983

Bharat Laxmidas Bhuva	Plano, TX
John William Luke Dille	Boone
William Henry Hatton	Raleigh
Brian Stephen Henling	New Orleans, LA
Dimitrios Spiridon Kalivas	Athens, Greece
Walter Michael Kwapien	Cary
Hsien Wu Lai	Taichung, Taiwan, Republic of China
Robert Talmadge Neece	Raleigh
Robert Jeffrey Norris	Morehead City
Susan Louise Pauling	Muncy, PA
Jiann-Haw Su	Kaohsiung, Taiwan, Republic of China
Tienhow Su	Kaohsiung, Taiwan, Republic of China

Degrees Conferred May 12, 1984

Lawrence Allen Arledge, Jr.	Asheville
Sudarshan Ashok Chitale	Bombay, India
Lewis James Faber	Raleigh
Sean Joshua Fletcher	Dublin, Ireland
Deborah Lynam Franke	Raleigh
Nancy Ellen Hubing	Houston, TX
Tai-Lai Daniel Hwang	Taipei, Taiwan, Republic of China
Mohammad Ali Khatibzadeh	Tehran, Iran
George William Knapp	Wintersville, OH
Reed Roberts May	Greensboro
Gerald Daniel Resutek	Tonawanda, NY
Donald Ray Stephens	Ruffin
Samuel Paul Stephenson	Willow Springs
James Edwin Vinson	Roanoke, AL
Mark Stephen Wieland	Vincetown, NJ
Jeffrey Edmund Wiggs	Newton
Dwight Lane Woolard	Washington

Ecology

Degree Conferred December 20, 1983

Ronald Eugene Ferrell	Fayetteville
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Entomology

Degrees Conferred August 10, 1983

Roger Dale Safrit	Salisbury
Odidika Christian Umeozor	Uga, Awka, Nigeria

Degrees Conferred December 20, 1983

Richard Alan Diehl	Raleigh
Mark Allen Schwartz	Kissimmee, FL
Lisa Louise Silberman	Highland Park, IL

Degrees Conferred May 12, 1984

Stewart M. Gray	East Longmeadow, MA
Douglas Alan Landis	Raleigh
Clyde Eugene Sorenson	Albemarle

Food Science

Degree Conferred August 10, 1983

Anne Chance Hopkins	Raleigh
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Degrees Conferred December 20, 1983

Jane Claire Burgarella	Sudbury, MA
Jeffrey Charles Randall	Mamaroneck, NY

Degrees Conferred May 12, 1984

Chinarong Patana-anake	Bangkok, Thailand
Susan Janet Read	Havelock
Richard Joseph Szyperski	Atlanta, GA

Forestry

Degree Conferred August 10, 1983

Charles Alan Williams	Austin, TX
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Degrees Conferred December 20, 1983

Patrick Michael Bean	Windsor, CT
Stith Thompson Gower	Danville, KY
Kathleen Marie Kenney	Raleigh

Degrees Conferred May 12, 1984

Paul Victor Bolstad	Apex
Sheryl Diane Brown	East Berne, NY
Bruce Maynard Emery	Montvale, NJ
Gary Kawathen Grubbs	Winston-Salem
Luc Emile Paques	Namur, Belgium
Richard Raymond Resovsky	Taylor, MI

Genetics

Degree Conferred August 10, 1983

Bradford Dean Loucas	Howell, NJ
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Degree Conferred May 12, 1984

Stacy Otelia Ross	Clinton, MD
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Geology

Degree Conferred August 10, 1983

Noelle Ann France	Woodstock, NY
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Degree Conferred May 12, 1984

Mohamed Mohamed ElBashir	Khartoum, Sudan
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Horticultural Science

Degrees Conferred August 10, 1983

Lorraine Denise Brisson	West Springfield, MA
Amanda Rebekah Walker	Reidsville

Degrees Conferred December 20, 1983

Linda Colleen Askey	North Augusta, SC
Allan Frederick Nash	West Springfield, MA

Degrees Conferred May 12, 1984

John David Abbott	Pawtucket, RI
Douglas James Doohan	Fredericton, New Brunswick, Canada
David Scott Douches	Hillside, NJ
Paul Thomas Karlovich	Mechanicsburg, PA
Catherine Anne Whealy	Fort Myers, FL

Industrial Engineering

Degrees Conferred August 10, 1983

Prakash Basavappa	Charlotte
Thomas John Sluchak	Detroit, MI
Lawrence Dale Thomas	Albertville, AL

Degrees Conferred December 20, 1983

Jui-Hsing Huang	Tainan, Taiwan, Republic of China
Christopher Thomas Irwin	Sparta
Jack Yehoshua Mantinband	Durham
Charles Rea Rivenbark	Wilmington
Joel Fredrick Zeugner	Asheville

Degrees Conferred May 12, 1984

Edward Lowry Babb	Cary
Karen Sue Eichman	Chapel Hill
James Matthew Frazier	Greensboro
Kyoochil Hahn	Seoul, Korea
Robert Jeffery Wallace	Foley, AL

Management

Degree Conferred August 10, 1983

Kathy Paulette McMillan	Fayetteville
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Degrees Conferred December 20, 1983

Elizabeth Blaylock	Raleigh
Martha Helen Callis	Raleigh
Gail Marie Diaz	San Juan, Puerto Rico
Richard Craig Little	Raleigh

Degrees Conferred May 12, 1984

Kumar Vishwas Haté	Raleigh
Brenda Owen Johnston	Raleigh
Devanath C. Kuchangi	Bangalore, India
Nancy Perkins Miller	Lenoir
James Mellen Niver	Raleigh
Jerome Paul Reimann	Henderson
Walter Victor Zamora	San Salvador, El Salvador

Marine, Earth and Atmospheric Sciences

Degrees Conferred August 10, 1983

Robert Michael Dolfi	Mahopac, NY
Brent Andrew McKee	Seagrove
James Byron Near, Jr.	Hilton Head Island, SC
Charlotte Louise Otts	Raleigh

Degrees Conferred December 20, 1983

Dae Won Byun	Andong, Korea
Ronald Luther Humble	Reno, NV
Rajendra Singh Rathore	Budaun, U.P., India
Karen May Shumac	Erie, PA
Mary Theresa Siedlecki	Minneapolis, MN
Sandra L. Rhyne Smith	McFarlan
Kathryn Thorbjarnarson	Norwood, NJ

Degrees Conferred May 12, 1984

Jeffrey Michael Alexander	Westfield, NJ
Susan Krongold Liddle	Raleigh
Thomas Everett Pierce, Jr.	Gaithersburg, MD
Roger Steele Turner	Mt. Olive

Materials Engineering

Degrees Conferred December 20, 1983

Hrong-Ji Leu	Taipei, Taiwan, Republic of China
Nenchin Liu	Taipei, Taiwan, Republic of China

Degree Conferred May 12, 1984

Chuti Suchjakul	Phuket, Thailand
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Mathematics

Degree Conferred December 20, 1983

Shih-Ya Hsu	Taipei, Taiwan, Republic of China
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Degrees Conferred May 12, 1984

John Edward Rose	Raleigh
Ramasubram Suresh	Madurai, India

Mathematics (Applied)

Degrees Conferred August 10, 1983

Lounis Amtout	Kouba, Algeria
Maurizio Benassi	Busseto, Italy
Michael Waitsell Berry	Snellville, GA

Degrees Conferred December 20, 1983

Ampron Dhamacharoen	Chonburi, Thailand
Vicki Carol Roller	South Boston, VA

Degrees Conferred May 12, 1984

Eric Dassaw-weh Benson	Brewerville, Liberia
Joan Elizabeth Burri	Raleigh

Mathematics Education

Degree Conferred December 20, 1983

Diane Weathers Johnson Cary

Mechanical Engineering

Degrees Conferred August 10, 1983

Douglas Alan Baker Erie, PA
John M. DeCicco Raleigh
Chih-Hong Ho Taipei, Taiwan, Republic of China
Athanasios George Papathanasiou Athens, Greece
Curtis Lorenz Progl Raleigh

Degrees Conferred December 20, 1983

Lee Arnold Kania Sanford
Walter Denton Scott Raleigh
Pradeep Kumar Vitta Raleigh

Degrees Conferred May 12, 1984

John Thomas Carroll III Cary
Stephen Lloyd Martin Chapel Hill

Meteorology

Degree Conferred December 12, 1983

Matthew Eugene Capuano Mendham, NJ

Degrees Conferred May 12, 1984

Orren Russell Bullock, Jr. Raleigh
Brian Keith Eder Raleigh
Mark Charles Shipman Fort Mill, SC

Microbiology

Degree Conferred December 20, 1983

Dana Robin Marshall Newark, DE

Degrees Conferred May 12, 1984

Virginia Kelly Ayers Blacksburg, VA
Gabriela Campodonico Lima, Peru
Claudia Newell Emery Colonie, NY
Joan Ellen Humphreys Greenhills, OH
Su-Mei Kao Taipei, Taiwan, Republic of China
Jean Louise Martin Statesville

Nuclear Engineering

Degrees Conferred December 20, 1983

Bader Abid Karachi, Pakistan
Ali Regimand Tehran, Iran
Gen-Yie Wang Raleigh

Degree Conferred May 12, 1984

Brit Elkington Hey Raleigh

Nutrition

Degrees Conferred August 10, 1983

Budi Haryanto	Semarang, Indonesia
Scott Charles Steinsberger	Raleigh

Degree Conferred December 20, 1983

**Jennifer Sue Heath	Whitesboro, NY
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Degree Conferred May 12, 1984

Jean-Marie Luginbuhl	Neuchâtel, Switzerland
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Operations Research

Degrees Conferred December 20, 1983

Richard Rathbun Bell	Meredithville, VA
Carlos Roberto Fernandez Torres	Monterrey, Mexico

Degrees Conferred May 12, 1984

Anthony Hall Colby	Alabaster, AL
Derek Scott Graham	Louisville, KY

Physics

Degrees Conferred December 20, 1983

Gary Bruce Adams	Kamuela, HI
Lynette Renee Perrell	Broadview Heights, OH

Degree Conferred May 12, 1984

Nicholas Robert Guilbert IV	Ambler, PA
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Physiology

Degrees Conferred May 12, 1984

Jeffrey Dyer Armstrong	Kuttawa, KY
Wallace Denver Berry, Jr.	Bessemer City
Gary Sherman Davis	Greensboro

Plant Pathology

Degree Conferred August 10, 1983

Karen Ann Narken	Poughkeepsie, NY
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Degree Conferred December 20, 1983

Betsy Lou Randall	Raleigh
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Degrees Conferred May 12, 1984

Amoncho Adiko	Abidjan, Ivory Coast
Richard Sean Gurkin	Clinton
Cynthia Kay Ragland	Burkeville, VA
Wayne Martin Thal	Wayne, PA

Poultry Science

Degree Conferred December 20, 1983

Kurt Edmond Richardson	Jacksonville
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** Co-major in Toxicology. See page 91.

Psychology

Degrees Conferred August 10, 1983

Charlotte Anne Michie	Norfolk, VA
Mescal Ruthelle Russell	Albany, GA
Bjorg Magda S. Thayer	Cary

Degrees Conferred December 20, 1983

Jane Ellen Beaver	Roanoke, VA
Charles Lavon Johnson, Jr.	Raleigh
Linda Joy William Phillips	Fort Myers, FL
Thomas Dimock Wason	Raleigh

Degrees Conferred May 12, 1984

Patricia Walton Collins	Raleigh
Mariann Bernadette Weiler	Greensboro

Recreation Resources Administration

Degree Conferred August 10, 1983

Barbara Louise McDonald	Midlothian, VA
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Degrees Conferred December 20, 1983

Michael Arthur Lahman	Cedar Rapids, IA
Terry Lynne McElrath	Black Mountain
Virginia McCormick Sherrington	Arcadia, FL

Degree Conferred May 12, 1984

Bayard Charles Alcorn	Salisbury
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Rural Sociology

Degree Conferred August 10, 1983

Mary Ellen DePuew Freedman	Cary
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Degree Conferred December 20, 1983

Michael Glenn Cogdill	Inman, SC
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Degree Conferred May 12, 1984

Georganne Louise McMullen	Palm Beach Gardens, FL
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Science Education

Degrees Conferred August 10, 1983

Phyllis Lynn-Hairr Edgerton	Raleigh
Joseph Steven Oliver	Hudson

Soil Science

Degrees Conferred August 10, 1983

Antonio Zubiria Galindez	Bilboa, Spain
Dan William Gill	Raleigh
Keith Lester Weier	Brisbane, Queensland, Australia

Degrees Conferred December 20, 1983

Aminata Niane	Dakar, Senegal
Modou Sene	N'Dondol, Senegal
Robert Henry Teyker	West Long Branch, NJ

Degrees Conferred May 12, 1984

Toney Cecil JacobsSalisbury
Lisa Beth Katz Vienna, VA
Indrek Porro Seabrook, NJ

Special Education

Degree Conferred December 20, 1983

Vicki Kuether DeMasterCary

Degrees Conferred May 12, 1984

Randall Gregory Rusch Durham
Patricia Hogan Warren Raleigh

Statistics

Degree Conferred August 10, 1983

*Sarah Margaret Nusser Iowa City, IA

Textile Chemistry

Degree Conferred August 10, 1983

Young Keun HongSeoul, Korea

Degrees Conferred May 12, 1984

Hope Linda BoberRandallstown, MD
Kimberly Byrd PriceBurkeville, VA

Textiles

Degree Conferred August 10, 1983

Werasak UdomkichdechBangkok, Thailand

Degree Conferred December 20, 1983

Tushar Dwijendar Desai Ahmedabad, India
Sandra Kay Stamper Longmont, CO

Degrees Conferred May 12, 1984

Linda Brown Cartner Greenville
Thomas Michael Ferguson Siler City

Toxicology

Degrees Conferred December 20, 1983

Robert Glen Best Bethlehem, PA
**Jenifer Sue Heath Whitesboro, NY

Degree Conferred May 12, 1984

Shari Jill StowersCary

Wildlife Biology

Degrees Conferred August 10, 1983

Richen Middleton BrameKinston
Timothy Gregory O'Brien Ashtabula, OH

* Co-major in Botany. See page 82.

** Co-major in Nutrition. See page 89.

Degree Conferred May 12, 1984

Stephen Edward Klause Raleigh

Wood and Paper Science

Degrees Conferred August 10, 1983

Janet Cheek Campbell Elon College
Elizabeth Dickson Gerrard Charlotte

Degree Conferred December 20, 1983

Hasmin Rusli Medan, Indonesia

Zoology

Degrees Conferred August 10, 1983

Christopher Fred Bonzek Syracuse, NY
David Walter Herr Lancaster, PA

Degree Conferred May 12, 1984

Benjamin McNinch Currin Raleigh

Doctor of Education Degrees

Degrees Conferred August 10, 1983

- Gloria Kathryn Bottoms, Adult and Community College Education
Elm City, North Carolina
Dissertation: An Analysis of Factors Associated with the Enrollment of Adults in Fundamental Education Programs of the North Carolina Community College Sytem. (Under the direction of Ronald W. Shearon.)
- Azimi Haji Hamzah, Adult and Community College Education
Kuala Lumpur, Malaysia
Dissertation: A Methodology for Converting Expressed Needs into Bases for Programming for Young Adults: An Exploratory Study. (Under the direction of G. L. Carter, Jr.)
- Richard Monaduke House, Adult and Community College Education
Tarboro, North Carolina
Dissertation: Standards of Practice in Continuing Education: A Status Study. (Under the direction of Grover J. Andrews and Edgar J. Boone.)
- Robert Kenneth Melvin, Occupational Education
Rockingham, North Carolina
Dissertation: Relationship between the Time of Application for Admission and Retention of Technical College Students. (Under the direction of Durwin M. Hanson and Charles D. Bryant.)
- Rebecca Racer Reed, Occupational Education
Raleigh, North Carolina
Dissertation: Peer Acceptance of Handicapped Students Mainstreamed into Secondary Vocational Education. (Under the direction of Joseph R. Clary and Linda S. Dillon.)
- Mary Rogers Rose, Curriculum and Instruction
Fuquay-Varina, North Carolina
Dissertation: The Relationship between Children's Concept of Story and Reading Comprehension of Narrative Prose. (Under the direction of Mary D. Siedow and Barbara M. Parramore.)
- Jane Moore Smink, Industrial Arts Education
Blacksburg, South Carolina
Dissertation: The Design and Field Test of an In-Service Education Needs Self-assessment for North Carolina Industrial Arts Teachers. (Under the direction of Talmage B. Young.)
- Carolyn Flowe Williams, Occupational Education
Charlotte, North Carolina
Dissertation: An Investigation of the Relationship between Selected Socioeconomic Variables and Local Support for Vocational Education as a Monetary Expression of Public Attitudes toward Vocational Education in North Carolina. (Under the direction of Joseph R. Clary.)

Degrees Conferred December 20, 1983

- Woodbridge Calvin Brown, Occupational Education
Welcome, North Carolina
Dissertation: Validation of Technical Competencies for the Manufacturing Engineering Technology Baccalaureate Degree Program at Western Carolina University. (Under the direction of Robert E. Wenig and Thomas C. Shore, Jr.)
- Margaret Gorely Bye, Adult and Community College Education
Raleigh, North Carolina
Dissertation: An Analysis of the Continuing Education Needs of Nurses in Nursing Homes in North Carolina. (Under the direction of Ronald W. Shearon.)
- Michael Chalmers, Adult and Community College Education
Canton, Georgia
Dissertation: A Study of Factors Related to Student Enrollment in North Carolina Adult Basic Education Programs. (Under the direction of Joan W. Wright.)
- Reuben Richard French, Occupational Education
Raleigh, North Carolina
Dissertation: Factors Contributing to the Emphasis Placed on Supervised Occupational Experience in Vocational Agriculture Programs in North Carolina. (Under the direction of Joseph R. Clary.)
- Margaret Mize Gransee, Curriculum and Instruction
Cary, North Carolina
Dissertation: Effects of Affective-oriented and Cognitive-oriented Pre-reading Instruction on Seventh Graders' Reading Comprehension. (Under the direction of Barbara J. Fox.)
- James Harry Guth, Educational Administration and Supervision
Garner, North Carolina
Dissertation: The Relationship between Selected Schooling Inputs and Processes and Gains in Elementary School Pupil Achievement in Reading, Language Arts and Mathematics. (Under the direction of Carl J. Dolce.)
- Robert Ronald Piragowski, Adult and Community College Education
Fayetteville, North Carolina
Dissertation: Perceived Needs That Influence Military Personnel and Civilians to Enroll in Undergraduate Degree Courses: A Comparative Analysis. (Under the direction of William L. Gragg.)
- Dallas Otto Tucker, Jr., Guidance and Personnel Services
Cary, North Carolina
Dissertation: The Manipulation of Race in Moral Dilemmas and Its Effect on Moral Reasoning of White and Black College Students. (Under the direction of Don C. Locke.)

Doris Terry Williams, Adult and Community College
Education
Wise, North Carolina

Dissertation: An Examination of a Participative Design for Instruction in
Adult Basic Education. (Under the direction of Joan W.
Wright.)

Degrees Conferred May 12, 1984

Richard Lynn Bogart, Occupational Education
Imlay City, Michigan

Dissertation: High Technology Training Needs of Community College
Business Instructors. (Under the direction of John K. Coster.)

Delane Florentene Boyer, Adult and Community College
Education
Raleigh, North Carolina

Dissertation: Critical Issues Facing the North Carolina Community College
System in the Decades of the 1980's. (Under the direction of
Ronald W. Shearon.)

Carmen Yolanda Carrasquillo, Adult and Community College
Education
Gurabo, Puerto Rico

Dissertation: The Role of the Subject-matter Specialist in the Puerto Rico
Agricultural Extension Service. (Under the direction of R.
David Mustian and Edgar J. Boone.)

Jo Ann Baughan Dalton, Adult and Community College
Education
Durham, North Carolina

Dissertation: An Analysis of the Effect of an Adult-oriented Teaching-
Learning Transaction on Pain Relief for Cancer Patients
Treated in the Out-patient Clinic of a Large North Carolina
Medical Center. (Under the direction of J. Conrad Glass, Jr.)

Frank Arnett Gourley, Jr., Occupational Education
Rocky Mount, Virginia

Dissertation: Administrators of Engineering Technology Programs: A
Study of Job Competencies through Self-assessment. (Under
the direction of Maynard J. Iverson.)

Daniel Edwards Hardee, Occupational Education
Greenville, North Carolina

Dissertation: Relationships between Selected Variables Identified in the
Follow-up of Secondary Vocational Education Program Com-
pleters/Leavers. (Under the direction of Joseph R. Clary.)

Sonja Turner Hutchins, Adult and Community College
Education
Concord, North Carolina

Dissertation: Factors Associated with Persistence in Beginning Shorthand
at the Community College Level. (Under the direction of
Ronald W. Shearon and Dale F. Campbell.)

- Mary Kinsland Kirkpatrick, Adult and Community College Education
Canton, North Carolina
- Dissertation: Two Educational Approaches to a Primary Prevention Hypertension Lesson Series: A Comparative Analysis. (Under the direction of Edgar J. Boone.)
- Susan Kim Dedrick MacGregor, Curriculum and Instruction
Raleigh, North Carolina
- Dissertation: The Effects of Questioning-strategy Training Delivered by a Computerized-text System on the Comprehension, Vocabulary and Metacognition of Third Grade Students. (Under the direction of Barbara J. Fox.)
- Mary Taylor Martof, Occupational Education
Chapel Hill, North Carolina
- Dissertation: Stress in New-graduate Registered Nurses in North Carolina. (Under the direction of Joseph R. Clary and Linda S. Dillon.)
- Julia Raye Mobley, Occupational Education
Raleigh, North Carolina
- Dissertation: A Goal-free Evaluation of an Occupational Exploration Program. (Under the direction of John K. Coster.)
- Bruce Clark Rogers, Occupational Education
Lorain, Ohio
- Dissertation: Impact of Writings of Ellen G. White on Work and Education for Work in Seventh-day Adventist Academies. (Under the direction of John K. Coster and Richard E. Peterson.)
- Richard Edgar Traylor, Adult and Community College Education
Newport News, Virginia
- Dissertation: An Exploratory Study of Southern Baptist Ministers in North Carolina and Their Relationship to an Involvement in Continuing Education. (Under the direction of Richard T. Liles and Edgar J. Boone.)
- Carroll Shaw Whitney, Occupational Education
Fairmont, West Virginia
- Dissertation: A Comparison of the Legislative Intent to the Existing System for Serving the Handicapped within North Carolina Postsecondary Institutions. (Under the direction of John K. Coster.)

Doctor of Philosophy Degrees

Degrees Conferred August 10, 1983

- Sasan Houston Ardalan, Electrical Engineering
Tehran, Iran
- Dissertation: Parametric and Nonparametric Fast Kalman Echo Cancellation. (Under the direction of John B. O'Neal, Jr. and S. Thomas Alexander.)
- Abdel-Wahed Badr, Biological and Agricultural Engineering
Garner, North Carolina
- Dissertation: Development and Application of a Simulation Model for Controlling Drainage Channels. (Under the direction of R. Wayne Skaggs.)
- Jane Beatrice Barrows-Broadus, Plant Pathology
Athens, Georgia
- Dissertation: Pitch Canker of Southern Pines: Histopathology and Biocontrol of the Causal Agent, *Fusarium moniliforme* var. *subglutinans*. (Under the direction of Larry F. Grand.)
- Jack Alan Berdasco, Chemistry
Santurce, Puerto Rico
- Dissertation: ^{13}C -T₁ Measurements of Various Barbituric Acid Derivatives in Solution. (Under the direction of Charles G. Moreland.)
- Martha Lineberger Bouknight, Mathematics Education
Gastonia, North Carolina
- Dissertation: The Effects of Instructional Method on Types of Learning Outcomes as Evidenced by Differential Performance. (Under the direction of John R. Kolb and Larry W. Watson.)
- Janet Vera Brotschol, Forestry and Genetics
Morrisville, Pennsylvania
- Dissertation: Allozyme Variation in Natural Populations of *Liriodendron tulipifera* L. (Under the direction of Gene Namkoong and Robert C. Kellison.)
- Alton Gailey Campbell, Jr., Wood and Paper Science
Pittsboro, North Carolina
- Dissertation: A Bench-Scale Evaluation of a Process for Decolorization of Bleach Plant Effluent Using the White-Rot Fungus *Phanerochaete chrysosporium*. (Under the direction of Thomas W. Joyce and Hou-min Chang.)
- Ki Woon Chang, Crop Science
Gyeonggi-Do, Korea
- Dissertation: I. Changes in the Surface Chemistry of Tobacco Leaves during Flue-curing with Particular Emphasis on Trichomes. II. Changes in the Volatile Oils of Tobacco Leaves during Flue-curing. (Under the direction of Willard W. Weeks and Joseph A. Weybrew.)
- Michael McCune Cole, Psychology
Austin, Texas
- Dissertation: The Developmental Antecedents of Sexual Preference among Males. (Under the direction of Howard G. Miller.)

- Robert Warren Connelly, Chemical Engineering
Wilmington, Delaware
- Dissertation: The Induction and Measurement of Relaxation Processes in Glassy Poly(methyl Methacrylate) Microspheres by Sorption Techniques Involving the Lower Alcohols. (Under the direction of Harold B. Hopfenberg.)
- George Emmett DuVal III, Biochemistry
Richmond, Virginia
- Dissertation: Use of Immobilization Techniques to Study Enzyme Structure-Activity Relationships. (Under the direction of Harold E. Swaisgood.)
- Elssayed Mousa Elssamadisy, Economics and Statistics
Alexandria, Egypt
- Dissertation: The Effects of Credit Constraints in Dynamic Optimization by Consumers. (Under the direction of Thomas Johnson and Bibhuti B. Bhattacharyya.)
- Nicolaos George Fountis, Statistics
Moschato, Athens, Greece
- Dissertation: Testing for Unit Roots in Multivariate Autoregressions. (Under the direction of David A. Dickey and Bibhuti B. Bhattacharyya.)
- John Michael Golio, Electrical Engineering
West Frankfort, Illinois
- Dissertation: Ion-implanted MESFET's. (Under the direction of Nino A. Masnari and Robert J. Trew.)
- Patrick Carl Hauenstein, Psychology
South Hill, Virginia
- Dissertation: A Comparative Analysis of the Underlying Learning Processes in Behavior Modeling: Social Learning Theory Evaluated. (Under the direction of Paul W. Thayer.)
- Anne Evelyn Hershey, Zoology
Jacksonville, North Carolina
- Dissertation: Benthic Community Structure in an Arctic Lake. Fish Predation, Foraging Strategies and Prey Refugia. (Under the direction of John M. Miller.)
- Sudhendra Venkatesh Hublikar, Fiber and Polymer Science
Bombay, India
- Dissertation: A Mechanistic Study of the Vapor Phase Coloration of Textiles. (Under the direction of Ralph McGregor.)
- Jay Allan Jaffe, Psychology
New York, New York
- Dissertation: Effects of Expectancies, Perceptions of Competence and Support and Selected Factors on Reported Satisfaction, Turnover Intention and Burnout of Telephone 'Hotline' Volunteers. (Under the direction of Howard G. Miller.)
- David Warren Jensen, Mathematics
Colorado Springs, Colorado
- Dissertation: Derivations of a Prime Ring Which Satisfy a Polynomial Identity. (Under the direction of Jiang Luh.)

- Thomas Hubert Jones, Botany
Fayetteville, North Carolina
- Dissertation: A Revision of the Genus *Viburnum* section *Lentago* (Caprifoliaceae). (Under the direction of James W. Hardin.)
- Baruch Ephraim Karlin, Mechanical Engineering
Haifa, Israel
- Dissertation: Model Identification and Parameter Estimation of the Power, Lift and Drag of Light Aircraft from a Single Maneuver. (Under the direction of Frederick O. Smetana.)
- Kyung Yong Kim, Materials Engineering
Busan, Korea
- Dissertation: Densification of Shock-conditioned Ceramic Powder by Rate Control Sintering. (Under the direction of Hayne Palmour III.)
- Annie Joyce King, Food Science
Kinston, North Carolina
- Dissertation: Modification of Egg White with Oleic and Physicochemical Properties of Ovalbumin and Lysozyme Treated with Oleic Acid. (Under the direction of Harold E. Swaisgood and Hershell R. Ball, Jr.)
- Margaret Windley King, Microbiology
Wilmington, North Carolina
- Dissertation: Internalization and Transport of Macromolecules by Enterocytes of Small Intestine of Neonatal Pigs and the Epizootology of Rotavirus Infection in Weaned Pigs in a Closed Herd. (Under the direction of James G. Lecce.)
- Manuel Claudio Motta Macedo, Soil Science
Sao Manuel, Sao Paulo, Brazil
- Dissertation: Principles of Intercropping: Effects of Crop Combination, Row Arrangement and Plant Density on Yield, Yield Equivalency Ratios and Recovery of Fertilizer-applied Nitrogen by Legume-Nonlegume Intercrops. (Under the direction of Robert E. McCollum and Eugene J. Kamprath.)
- Azzam Nouman Mansour, Physics
Raleigh, North Carolina
- Dissertation: X-ray Absorption Studies of Silica-supported Platinum Catalysts. (Under the direction of Dale E. Sayers and Jan F. Schetzina.)
- Steven Edward McKeand, Forestry
Raleigh, North Carolina
- Dissertation: Growth and Development of Tissue Culture Plantlets of Loblolly Pine in a Greenhouse. (Under the direction of Bruce J. Zobel.)
- James Richard Mertz, Jr., Biochemistry
Fayetteville, North Carolina
- Dissertation: Iron Storage in Sheep during Copper Toxicity and Maturation: Relationships of Iron Content to the Structure and Function of Spleen Ferritin. (Under the direction of Elizabeth C. Theil.)

- Michael Gerard Messina, Forestry
Pottsville, Pennsylvania
- Dissertation: Nutrient Content and Distribution in Natural Southern Coastal Plain Hardwoods. (Under the direction of Douglas J. Frederick and Russell Ballard.)
- Milton Mori, Nuclear Engineering
Campinas, S.P., Brazil
- Dissertation: Finite Element Method for Solving Linear and Nonlinear Time-dependent Coupled Mass Diffusion and Heat Problems in Media with Surface Erosion. (Under the direction of Kuruvilla Verghese and Robert E. White.)
- Glenn David Mroz, Forestry
Houghton, Michigan
- Dissertation: An Evaluation Whole Tree Harvest Effects on Northern Hardwood Soil-Site Relationships and Coppice Regrowth. (Under the direction of Douglas J. Frederick.)
- Thomas Hubbard Myers, Physics
Hickory, North Carolina
- Dissertation: Properties of CdTe Films Grown by Molecular Beam Epitaxy. (Under the direction of Jan F. Schetzina.)
- William Lee Pan, Soil Science
White Bear Lake, Minnesota
- Dissertation: Genotypic Traits Affecting Nitrate and Ammonium Assimilation during Vegetative and Reproductive Growth of *Zea mays* L. (Under the direction of William A. Jackson.)
- Carlos Orlando Ponchio, Soil Science
Araraquara, Sao Paulo, Brazil
- Dissertation: Citric Acid Solubility Evaluation of Phosphatic Materials for Fertilizer Usage on Soils Differing in Their Phosphorus Sorption Characteristics. (Under the direction of Frederick R. Cox.)
- Mark James Purdy, Chemical Engineering
Owensboro, Kentucky
- Dissertation: Operation and Modeling of a Pilot-scale Fluidized Bed Coal Gasifier. (Under the direction of Richard M. Felder and James K. Ferrell.)
- Robert Campbell Purnell, Forestry
Rockville, Connecticut
- Dissertation: Comparison of Breeding Strategies for European Black Alder. (Under the direction of Robert C. Kellison.)
- Theodore Roger Rice, Physics
Morehead City, North Carolina
- Dissertation: Poisson Summation Formulas and the Theta Function Summation Method for Porous Structures and Irregular Lattices in One Dimension. (Under the direction of George L. Hall.)
- Edgar Snider Sanders, Jr., Chemical Engineering
Hickory, North Carolina
- Dissertation: High-pressure Sorption of Pure and Mixed Gases in Glassy Polymers. (Under the direction of William J. Koros.)

Barbara Brewer Shew, Plant Pathology
Denver, Colorado

- Dissertation: The Epidemiology of Southern Stem Rot Caused by *Sclerotium rolfsii* on Peanut. (Under the direction of Marvin K. Beute.)

Marjolein van der Vaart Smith, Applied Mathematics and
Biomathematics
Leiden, Netherlands

- Dissertation: Stochastic Differential Equations from a Modeling Point of View with Special Emphasis on Biological Applications. (Under the direction of Harvey J. Gold.)

Harry Lee Stribling, Zoology
Greenville, North Carolina

- Dissertation: Relations of Agricultural Practices to the Ecology of the American Woodcock in Coastal North Carolina. (Under the direction of Phillip D. Doerr.)

Jane Catherine Trolinger, Plant Pathology
Asheboro, North Carolina

- Dissertation: Epidemiology of Botrytis Blight on Greenhouse Floral Crops. (Under the direction of David L. Strider.)

Mark Townsend Windham, Plant Pathology
Crystal Springs, Maryland

- Dissertation: Bean Pod Mottle Virus of Soybeans: Host Response, Disease Losses, Factors Affecting Disease Progression and Effects on Seed Mycoflora. (Under the direction of John P. Ross.)

Chih-Chen Yang, Biological and Agricultural Engineering
Chia-Yi City, Taiwan, Republic of China

- Dissertation: Simulation of a Multi-barn Solar Curing System for Tobacco. (Under the direction of William H. Johnson.)

Degrees Conferred December 20, 1983

Ezzaldin Omar Abusteit, Crop Science
Elbalyana, Egypt

- Dissertation: Toxicity, Absorption, Translocation and Metabolism of Metribuzin in Diploid and Tetraploid Soybean [*Glycine max* (L.) Merr.] Plant and Cell Cultures. (Under the direction of Frederick C. Corbin.)

Mohamad Aflatouni, Biological and Agricultural Engineering
Shiraz, Iran

- Dissertation: Evapotranspiration in the Presence of a Water Table. (Under the direction of R. Wayne Skaggs.)

Abdel Khaled Al-Sabeeh, Mechanical Engineering
Kuwait, Kuwait

- Dissertation: Finite-element Utilization in the Acoustical Improvement of Structure-borne Noise of Large Industrial Machines. (Under the direction of Thomas H. Hodgson and John S. Strenkowski.)

- James William Augustin, Psychology
Oconomowoc, Wisconsin
- Dissertation: Dimensions of Vocational Self-concept: Factor and Construct Validity Analyses of the Career Orientation Profile. (Under the direction of Joseph W. Cunningham.)
- Theodore Ray Bandy, Animal Science
Blue Mound, Illinois
- Dissertation: Direct and Maternal Genetic Differences and Influence of Litter Size in Lines of Mice Selected for Litter Size and Body Weight. (Under the direction of Eugene J. Eisen.)
- Helen Tudor Beauford-Murphy, Botany
Winston-Salem, North Carolina
- Dissertation: The Seed Surface Morphology of the Gesneriaceae Utilizing the Scanning Electron Microscope and a New System for Diagnosing Seed Morphology. (Under the direction of G. Ray Noggle.)
- Wayne Frank Beyer, Jr., Chemistry
Cleveland, Ohio
- Dissertation: The Copper Binding Properties of an Acidic Protein Isolated from Bovine Brain—the Similarities of Neurocuprein and the S-100 Proteins. (Under the direction of Robert D. Bereman.)
- Mark Cameron Black, Plant Pathology
Norman, Arkansas
- Dissertation: Host-Pathogen Interactions between *Arachis hypogaea* and *Cylindrocladium crotalariae*: Variability of Pathogen Virulence, Stability of Host Resistance, Inoculum Efficiency Factors and Characterization of Suppressive Soil. (Under the direction of Marvin K. Beute.)
- Marilyn Ann Buford, Forestry
Houston, Texas
- Dissertation: Probability Distributions as Models for Mortality in Loblolly Pine (*Pinus taeda* L.) Plantations. (Under the direction of William L. Hafley.)
- Clifford Million Carlin, Chemistry
Asheville, North Carolina
- Dissertation: Investigation of the Excited State Symmetry of Tris(bipyridine) ruthenium(II) and Related Complexes by Photoselection Spectroscopy. (Under the direction of M. Keith DeArmond and Kenneth W. Hanck.)
- Michael John Carson, Forestry
Rotorua, New Zealand
- Dissertation: Breeding for Resistance to Fusiform Rust in Loblolly Pine. (Under the direction of Bruce J. Zobel.)
- James Allen Chalfant, Economics and Statistics
Overland Park, Kansas
- Dissertation: Choosing among Flexible Functional Forms: An Application of the Generalized Box-Cox and Fourier Flexible Forms to U. S. Agriculture. (Under the direction of Paul R. Johnson and Thomas Johnson.)

- Rey Torn Chern, Chemical Engineering
Taichung, Taiwan, Republic of China
- Dissertation: Measurement and Modeling of Mixed Gas Permeation in Glassy Polymers. (Under the direction of William J. Koros and Harold B. Hopfenberg.)
- William Henry Doucette, Jr., Soil Science
Howell, Michigan
- Dissertation: Soil Survey Reliability for Intensive Land Management. (Under the direction of Stanley W. Buol.)
- Ibrahim Ahmed El Badawi, Statistics
Elnuhud, Sudan
- Dissertation: Semi-nonparametric Analysis of Consumer Demand Systems. (Under the direction of A. Ronald Gallant.)
- Barbara Hartley Grimes, Zoology
Williamsboro, New Jersey
- Dissertation: *Vampyrophrya pelagica*, a Histophagous Ciliate (Apostomatida, Ciliophora, Protozoa) Associated with Marine Calanoid Copepods; Its Adaptations to a Facultative Two-host Life Cycle, the Fine Structure of the Trophont Stage and Feeding Experiments with the Trophont. (Under the direction of Phyllis C. Bradbury.)
- Anatole Petrovich Grishin, Physics
Cary, North Carolina
- Dissertation: The Positive-Definite Metric and the Problem of the Charged Particle in the Einstein-Maxwell Theory. (Under the direction of Gerald H. Katzin.)
- Charles Clifton Havener, Physics
Raleigh, North Carolina
- Dissertation: Measurement of the $n=3$ Density Matrix Produced in Electron Transfer Collisions of Protons on Helium. (Under the direction of John S. Risley.)
- Sheila Willingham Hedges, Chemistry
Asheville, North Carolina
- Dissertation: ^{121}Sb Mössbauer and Raman Spectroscopic Studies of Selected Animony Compounds. (Under the direction of Lawrence H. Bowen.)
- Berman Duane Hudson, Soil Science
Cary, North Carolina
- Dissertation: The Use of Soil Classification to Predict Forest Site Quality on the Southeastern Coastal Plain. (Under the direction of Stanley W. Buol.)
- Show-Ming Hwang, Marine Sciences
Taitung, Taiwan, Republic of China
- Dissertation: The Interaction of Short Surface Gravity Waves with the Gulf Stream. (Under the direction of C. Ernest Knowles.)
- James Lyle Ivett, Toxicology
South Dayton, New York
- Dissertation: The Effect of Inhibition of Cytochrome P-450 Activity on Benzene-induced Genotoxicity and Cytotoxicity in Murine Hematopoietic Tissue. (Under the direction of Daniel S. Grosch.)

- Jayne Kathleen Klinger, Microbiology
Raleigh, North Carolina
Dissertation: Sindbis Virus Replication Is Restricted in Density-inhibited Vero Cell Monolayers. (Under the direction of Robert E. Johnston.)
- Robert Lagacé, Biological and Agricultural Engineering
Ste-Foy, Quebec, Canada
Dissertation: Predicting Drain Silting Potential. (Under the direction of R. Wayne Skaggs.)
- David Andrew Lawing, Physics
Charlotte, North Carolina
Dissertation: Broadline NMR Studies of Water in Graphite and Poly(p-Phenylene Terephthalamide) Fiber/Epoxy Composites. (Under the direction of Jasper D. Memory and Raymond E. Fornes.)
- José Vicente Lazo, Crop Science
Maracay, Venezuela
Dissertation: The Behavior and Fate of Chlorpropham and CGA-41065 in Flue-cured Tobacco Plants and Cell Cultures. (Under the direction of Frederick T. Corbin.)
- George Allan Lowerts, Forestry
Irvington, New Jersey
Dissertation: The Influence of Selected Wood Anatomical Features on the Development of Discoloration and Decay in Wounded Trees of Yellow-Poplar. (Under the direction of Robert C. Kellison.)
- Alan Alfred Lucier, Forestry
Stamford, Connecticut
Dissertation: Transformations and Movement of Urea and Ammonium Nitrite in a Piedmont Forest Soil. (Under the direction of Russell Ballard and Charles B. Davey.)
- Elizabeth Ann McDermid, Economics
Raleigh, North Carolina
Dissertation: An Economic Analysis of the Effect of Mortality Risk and Health on Labor Force Retirement. (Under the direction of Robert L. Clark and Thomas Johnson.)
- José Gerardo Montejano-Gaitan, Food Science
San Luis Potosi, Mexico
Dissertation: Thermally Induced Gelation of Selected Protein Systems—Rheological Changes during Processing, Final Strengths, Texture Profile Analysis, Sensory Texture and Microstructure. (Under the direction of Donald D. Hamann.)
- James Lee Osborne, Chemical Engineering
Greensboro, North Carolina
Dissertation: Fundamentals of Small Molecule Migration in Glassy Polymers. (Under the direction of Harold B. Hopfenberg.)
- Own Salem Own, Entomology
Subratah, Libya
Dissertation: Interactions of the Hymenopterous Parasite *Pediobius foveolatus* (Crawford) with Two Undescribed Microsporidia Pathogenic for the Mexican Bean Beetle, *Epilachna varivestis* Mulsant. (Under the direction of Wayne M. Brooks.)

- Samuel Lloyd Pardue, Physiology
Yadkinville, North Carolina
- Dissertation: Relationship of Ascorbic Acid to Physiological Stress in the Domestic Fowl. (Under the direction of J. Paul Thaxton.)
- William Michael Peirson, Marine, Earth and Atmospheric Sciences
Harborton, Virginia
- Dissertation: Physiological and Biochemical Factors Influencing the Nutritional Value of Phytoplankton as Food for the Bay Scallop, *Argopecten irradians concentricus* (Say). (Under the direction of Thomas G. Wolcott.)
- George Bogdan Poppe, Fiber and Polymer Science
Thomasville, North Carolina
- Dissertation: Cyanamide-assisted Esterification of Cellulose. (Under the direction of Charles Tomasino and Wilson M. Whaley.)
- Timothy Daryl Pyecha, Nuclear Engineering
Lynchburg, Virginia
- Dissertation: The Sorption of Cesium by Stronium-impregnated Nuclear Grade Graphite at High Temperature. (Under the direction of Lloyd R. Zumwalt.)
- David Harold Reifsnyder, Animal Science and Biochemistry
Gadsden, Alabama
- Dissertation: Methionine Hydroxy Analog as a Source of Methionine Activity in Young Pigs and Cell Culture. (Under the direction of Evan E. Jones.)
- Steven Lyle Riley, Entomology
Las Cruces, New Mexico
- Dissertation: Characterization of Migratory Flight Potential in the Tobacco Budworm, *Heliothis virescens* (Fabricius). (Under the direction of Ronald E. Stinner.)
- Mary Ellen Sanders, Food Science
Castro Valley, California
- Dissertation: Mechanisms and Plasmid Linkage of Bacteriophage Resistance in Group N Streptococci. (Under the direction of Todd R. Klaenhammer.)
- Arnold Myron Saxton, Animal Science
West Grove, Pennsylvania
- Dissertation: Genetic Relationships among Brown and White Adipose Tissue and Growth in Mice. (Under the direction of Eugene J. Eisen.)
- Charles Henry Schmelzer, Biochemistry
Reisterstown, Maryland
- Dissertation: Isolation and Characterization of Bovine Kidney Sulphydryl Oxidase and Comparison with the Milk Enzyme. (Under the direction of H. Robert Horton.)
- Michael Heal Scholla, Microbiology
Raleigh, North Carolina
- Dissertation: DNA Homology among the Rhizobia. (Under the direction of Gerald H. Elkan.)

- Roderick Keith Scott, Electrical Engineering
Greensboro, North Carolina
- Dissertation: Data Domain Modeling of Fault-tolerant Software Reliability. (Under the direction of David F. McAllister and James W. Gault.)
- Creighton Mark Seaford, Mechanical Engineering
Kannapolis, North Carolina
- Dissertation: A New Implicit Plus Minus Splitting Method for the Solution of the Euler Equations in the Transonic Flow Regime. (Under the direction of Hassan A. Hassan.)
- Donald Paul Segers, Chemistry
Akron, Ohio
- Dissertation: Unique Luminescence of Selected Transition-Metal Complexes. (Under the direction of M. Keith DeArmond.)
- Steven Ray Shafer, Plant Pathology
Marion, Ohio
- Dissertation: The Influence of Simulated Acidic Rain on Root-infecting Fungi. (Under the direction of Robert I. Bruck and Allen S. Heagle.)
- Donn Graham Shilling, Crop Science
McLean, Virginia
- Dissertation: The Suppression of Certain Weed Species by Rye (*Secale cereale* L.) Mulch and Isolation, Characterization and Identification of Water-soluble Phytotoxins from Rye. (Under the direction of A. Douglas Worsham.)
- Lonsworth Earl Smith, Psychology
Mansfield, Pennsylvania
- Dissertation: Job-analytically Based Interest Factors: Dimensions Underlying Work Activity Preferences among University Students. (Under the direction of Joseph W. Cunningham.)
- Randal Jay Southard, Soil Science
Logan, Utah
- Dissertation: Subsoil Blocky Structure Formation in North Carolina Coastal Plain Soils. (Under the direction of Stanley W. Buol.)
- Javad Taheri, Industrial Engineering
Raleigh, North Carolina
- Dissertation: Hierarchical Production Planning for Multi-stage Assembly Systems. (Under the direction of Raul E. Alvarez and Henry L. W. Nuttle.)
- Lucy Irene Terry, Entomology
Greenville, South Carolina
- Dissertation: The Effects of Cultural Practices on the Population Dynamics of the Corn Earworm, *Heliothis zea* (Boddie), in Soybeans in North Carolina. (Under the direction of Julius R. Bradley, Jr. and John W. Van Duyn.)
- Sharon Bischofshausen Thomas, Psychology
Chapel Hill, North Carolina
- Dissertation: The Effects of Inference Requirements on the Comprehension and Retrieval of Metaphors. (Under the direction of Lois A. Makoid and Rachel F. Rawls.)

- Kenneth Michael Tilt, Horticultural Science
Shelby, North Carolina
- Dissertation: Effects of Physical and Chemical Properties of Container and Propagation Media on the Growth and Rooting Response of Woody Ornamentals. (Under the direction of Frank L. Haynes and Theodore E. Bilderback.)
- Michael Linn Timmons, Electrical Engineering
Raleigh, North Carolina
- Dissertation: Growth of Aluminum Gallium Arsenide Antimonide/Gallium Arsenide Antimonide Monolithic, Cascade Solar Cells. (Under the direction of Salah M. Bedair and John R. Hauser.)
- Francis Daniel Watson, Botany
Charlottesville, Virginia
- Dissertation: A Taxonomic Study of Pondcypress and Baldcypress (*Taxodium* Richard). (Under the direction of James W. Hardin.)
- Lewis Curry Woods III, Zoology
Harrodsburg, Pennsylvania
- Dissertation: The Culture and Early Feeding Ecology of Hybrid Striped Bass. (Under the direction of J. Howard Kerby and Melvin T. Huish.)
- Catherine Thelma Wright, Food Science
Auburn, Maine
- Dissertation: Physiological, Morphological and Environmental Factors Influencing the Freezing Death of *Lactobacillus bulgaricus*. (Under the direction of Todd R. Klaenhammer.)
- Shi-Shen Yau, Materials Engineering
Taipei, Taiwan, Republic of China
- Dissertation: Crack Propagation in Corrosion-Fatigue of Metal-Matrix Composites. (Under the direction of Abdel A. Fahmy and George Mayer.)
- Decio Zylbersztajn, Economics
Sao Paulo, Brazil
- Dissertation: Price Distortions in Brazilian Agriculture: An Application of Duality Theory and Flexible Functional Forms. (Under the direction of Paul R. Johnson.)

Degrees Conferred May 12, 1984

- Ekram Fathy Abdel-Gawad, Operations Research
Cairo, Egypt
- Dissertation: Control of Arrivals and Routing in Networks of Queues with Applications to Communication Systems. (Under the direction of Shaler Stidham, Jr.)
- Mustafa Fituri Abusaid, Electrical Engineering
Benghazi, Libya
- Dissertation: Two-dimensional Numerical Modeling of Ion Implanted GaAs MESFET Devices. (Under the direction of John R. Hauser.)

- Cicely Moitinho Amaral, Economics
Sao Paulo, S.P., Brazil
- Dissertation: Information in United States Agriculture: The Farm Press.
(Under the direction of Richard K. Perrin and Loren A. Ihnen.)
- Arthur Wayne Bowman, Zoology
Hampton, Virginia
- Dissertation: Ethidium Bromide and Acriflavin Induced Alterations of
Kinetoplast DNA and Whole Cell Respiration in *Crithidia fasciculata*. (Under the direction of John F. Roberts.)
- John Vincent Boyne, Entomology
Beaufort, South Carolina
- Dissertation: Phenology of the Tufted Apple Budmoth, *Platynota idaeusalis*
(Walker) (Lepidoptera: Tortricidae): Effect of Photoperiod,
Temperature and Food and Diapause and Nondiapause
Development. (Under the direction of George C. Rock.)
- Joel Mark Chandlee, Genetics
Raleigh, North Carolina
- Dissertation: Molecular Genetic Mechanisms Regulating Gene Expression
during Development of Maize. (Under the direction of John G.
Scandalios.)
- Jaw Huoy Chou, Operations Research
Taipei, Taiwan, Republic of China
- Dissertation: Contributions to Nondifferential Mathematical Program-
ming. (Under the direction of Thomas W. Reiland and Elmor
L. Peterson.)
- Si-Yin Chung, Food Science
Canton, People's Republic of China
- Dissertation: Use of Immobilized Enzymes for Assessment of Changes in
Digestibility of Proteins as Caused by Processing Conditions.
(Under the direction of Harold E. Swaisgood.)
- Gwendolyn Victoria Clay, Mathematics Education
Greensboro, North Carolina
- Dissertation: The Semantic Meaning Theory of Arithmetic. (Under the
direction of John R. Kolb.)
- Melvin Frank Copeland, Toxicology
Cary, North Carolina
- Dissertation: Some Factors Affecting Metabolism of Lindane in the Rat.
(Under the direction of Ernest Hodgson.)
- Ismail Erdem, Operations Research and Statistics
Ankara, Turkey
- Dissertation: Three Phase Sampling for Misclassified Binary Data. (Under
the direction of Charles H. Procter.)
- Thomas Stephen Everett, Chemistry
Lutherville-Timonium, Maryland
- Dissertation: Preparation of α -Trifluoromethyl Esters from Malonic Esters.
(Under the direction of Carl L. Bumgardner and Suzanne T.
Purrington.)

- Nancy Jane Becker Fair, Fiber and Polymer Science
Columbia, Missouri
- Dissertation: The Effect of Chlorination on Friction and Surface Morphology of Dark Brown and Blond Human Hair Fibers. (Under the direction of Bhupender S. Gupta.)
- John Calvin Farrar, Psychology
Lynchburg, Virginia
- Dissertation: Effects of Training in Divergent Thinking on Learning Mathematics by Fourth Grade Children. (Under the direction of Harold M. Corter.)
- Robert Russell Farrar, Jr., Entomology
Fayetteville, Tennessee
- Dissertation: The Distribution and Survival of *Heliothis* spp. Eggs and Larvae on Cotton Plants. (Under the direction of Julius R. Bradley, Jr.)
- Lewis John Frampton, Jr., Forestry
Fort Myers, Florida
- Dissertation: *In vitro* Studies of Disease Resistance in Loblolly Pine. (Under the direction of Robert J. Weir and Robert I. Bruck.)
- Aaron Givens, Psychology
Los Angeles, California
- Dissertation: An Examination of the Relationship between Ego Development and Managerial Competencies. (Under the direction of M. Henry Pitts and Donald W. Drewes.)
- James Jackson Griffith, Forestry
Vicos, Minas Gerais, Brazil
- Dissertation: Economic Motives for Contributing to the Nature Conservancy. (Under the direction of Thomas O. Perry.)
- Susan Hewlett Hall, Biochemistry
Raleigh, North Carolina
- Dissertation: Regulation of Ovine Luteinizing Hormone Alpha and Beta Subunit mRNAs by 17β -estradiol. (Under the direction of William L. Miller.)
- David Andrew Harcharik, Forestry
Streator, Illinois
- Dissertation: The Timing and Economics of Irrigation in Loblolly Pine Seed Orchards. (Under the direction of Bruce J. Zobel.)
- Robert Allan Hester, Jr., Statistics
Bushy Fork, North Carolina
- Dissertation: Uniform Residuals and NU Residuals Tests for Heteroscedasticity. (Under the direction of Charles P. Quesenberry.)
- Ronnie Gates Hise, Wood and Paper Science
Big Spring, Texas
- Dissertation: Delignification Mechanisms in Kraft-AQ and Soda-AQ Pulp: The Role of Oxidative-Hydrolytic Processes in the Cleavage of Carbon-Carbon Bonds. (Under the direction of Joseph S. Gratzl and Chen-Loung Chen.)

- Long-Rong Kao, Toxicology
Taipei, Taiwan, Republic of China
Dissertation: Studies of Multiple Forms of Esterases Involved in Insecticide Detoxication and Resistance. (Under the direction of Walter C. Dauterman.)
- Phillip Scott Kerr, Crop Science
Sikeston, Missouri
Dissertation: Biochemical Regulation of Photosynthate Partitioning and Its Relation to Whole Plant Growth of Soybeans [*Glycine max* (L.) Merr.]. (Under the direction of Steven C. Huber and Daniel W. Israel.)
- Stephen Robert Koenning, Plant Pathology
Tucson, Arizona
Dissertation: The Ecology and Damage Potential of *Pratylenchus brachyurus* on Soybean. (Under the direction of Donald P. Schmitt and Kenneth R. Barker.)
- Robert Keith Koger, Industrial Engineering
Raleigh, North Carolina
Dissertation: Decision Analysis Applied to Electric Utility Rate Design. (Under the direction of John R. Canada and William A. Smith, Jr.)
- John Willson Laskey, Physiology
Apex, North Carolina
Dissertation: An Investigation into the Effect of Chronic Manganese (Mn_3O_4) Administration to the Effect of Chronic Manganese (Mn_3O_4) Administration of Selected Reproductive Parameters. (Under the direction of Frank W. Edens and Charles H. Hill.)
- Paul Tzongpai Lin, Toxicology
Taipei, Taiwan, Republic of China
Dissertation: Studies on the *In vitro* Metabolism of Malathion Homologs by Rabbit Liver Carboxylesterases and the Inhibition of Carboxylesterases by Organophosphorus Impurities Found in Technical Malathion. (Under the direction of Walter C. Dauterman.)
- Tan Synn Lymn, Chemistry
Georgetown, West Malaysia
Dissertation: Enrichment and Analysis of Trace Organic Compounds in Aqueous Solution and Electrochemistry of Bis-Bipyridyl Ruthenium(II) Complexes. (Under the direction of Kenneth W. Hanck and Jon Bordner.)
- Henry Joseph Mascagni, Jr., Soil Science
Natchez, Mississippi
Dissertation: The Diagnosis and Correction of Manganese Deficiency in Soybeans and Corn. (Under the direction of Frederick R. Cox.)
- Ann Davis Matheny, Psychology
Raleigh, North Carolina
Dissertation: Appgar Scores and Low Birthweight as Predictors of School Success in High Risk Infants. (Under the direction of Rachel F. Rawls.)

- Kevin James McBride, Psychology
Rocky Mount, North Carolina
- Dissertation: Factors Influencing Parole Decision-making of Correctional Psychologists. (Under the direction of Howard G. Miller.)
- Michael Eugene McDonald, Civil Engineering and Zoology
Lesterville, Missouri
- Dissertation: Trophic Interactions and Carbon Budgets for the Sub-reproductive Adult Phytoplanktivorous Fish, *Tilapia aurea*, Fed Three Unialgal Cultures, with Models for an Algae-Phytoplanktivorous Fish Wastewater Nutrient Removal System. (Under the direction of George T. Barthalmus, John M. Miller and William S. Galler.)
- David Edwin Morris, Chemistry
Charlotte, North Carolina
- Dissertation: Electrochemical and Electron Spin Resonance Spectroscopic Studies of d⁶ Transition-Metal Complexes of Imine Ligands. (Under the direction of Kenneth W. Hanck and M. Keith DeArmond.)
- Sharif Moh'd Sharif Musameh, Physics
Shweikah, Israel
- Dissertation: Determination of Depth Profile of an Implanted Ion Species. (Under the direction of Arthur W. Waltner.)
- Anil Narayan Netravali, Fiber and Polymer Science
Bombay, India
- Dissertation: The Influence of Water and High Energy Radiation on the Thermal and Spectroscopical Characteristics of an Epoxy. (Under the direction of Raymond E. Fornes.)
- James Patrick Noe, Plant Pathology
Raleigh, North Carolina
- Dissertation: Spatial Population Dynamics of Plant Parasitic Nematodes. (Under the direction of Kenneth R. Barker.)
- Mohamed Shtawi Omer, Civil Engineering
Tripoli, Libya
- Dissertation: Prediction of Performance of Flexible Pavements Using VESYS IIIA Structural Subsystem. (Under the direction of John W. Horn and N. Paul Khosla.)
- Mohsen Mohamed Osman, Mechanical Engineering
Alexandria, Egypt
- Dissertation: Temperature Distribution of the Normal and Malignant Human Tissue: Thermal Modeling of the Breast Cancer. (Under the direction of Elsayed M. Afify.)
- Alan Parker, Electrical Engineering
Marietta, Georgia
- Dissertation: Linear Predictive Coding with Multi-pulse Excitation. (Under the direction of J. Benjamin O'Neal, Jr.)
- James Lee Powell, Psychology
Hayesville, North Carolina
- Dissertation: Intergenerational Learning of Assertive and Aggressive Behaviors in Rural Appalachian Families. (Under the direction of Howard G. Miller and Margaret N. Wiebe.)

Stephen Douglas Prosch, Crop Science
LaGrange, Illinois

Dissertation: Factors Affecting the Synergistic Interaction of Trifluralin and Alachlor in Controlling Broadleaf Weed Species in Soybeans. (Under the direction of Jerome B. Weber.)

Mulia Purba, Marine, Earth and Atmospheric Sciences
Bogor, Indonesia

Dissertation: A Parametric Evaluation of Observations in the Georgia Bight, March-May, 1980. (Under the direction of Leonard J. Pietrafesa and Gerald S. Janowitz.)

Jayantha Ranjith Rajasekera, Operations Research
Gampaha, Sri Lanka

Dissertation: Perturbational Techniques for the Solution of Posynomial, Quadratic and l_p -Approximation Programs. (Under the direction of Elmor L. Peterson.)

Prabha Kuthur Ramakrishnan, Physics
Madras, India

Dissertation: Amplitude and Width Correlations in ^{57}Co and ^{49}V . (Under the direction of Gary E. Mitchell.)

Camelia Ravanbakht, Civil Engineering
Raleigh, North Carolina

Dissertation: Geometric Programming: An Efficient Computer Algorithm for Traffic Assignment. (Under the direction of Paul D. Cribbins and John R. Stone.)

Russell Alan Rebertus, Soil Science
Raleigh, North Carolina

Dissertation: Occurrence and Distribution of Kaolin and Gibbsite in Hapludults and Dystrichrepts Formed from Mica Gneiss and Schist in North Carolina. (Under the direction of Stanley W. Buol.)

Danny Dale Rogers, Crop Science
Knoxville, Tennessee

Dissertation: Fall Sod-seeding of Alfalfa and Ladino Clover into Tall Fescue as Influenced by Time of Seeding and Grass and Insect Suppression. (Under the direction of Douglas S. Chamblee.)

Mahmoud Mohamed Salama, Fiber and Polymer Science
Cairo, Egypt

Dissertation: Mechanics of Air-jet Filling Insertion. (Under the direction of Mansour H. Mohamed.)

David Lee Sanford, Horticultural Science
Urbana, Illinois

Dissertation: Greenhouse Crop Optimization Programs: A Partial Data Base. (Under the direction of Paul V. Nelson.)

Lawrence Howell Sawyer, Fiber and Polymer Science
Raleigh, North Carolina

Dissertation: Nonequilibrium Aspects of Fibrous Structures. (Under the direction of T. Waller George.)

- William David Smith, Crop Science
Live Oak, Florida
- Dissertation: Response of Flue-cured Tobacco to Sulfur Application of Soils Differing in Depth to the Argillic Horizon. (Under the direction of William K. Collins and Gerald F. Peedin.)
- Richard Anthony Snieszko, Forestry
Orange, California
- Dissertation: Inbreeding and Outcrossing in Loblolly Pine. (Under the direction of Bruce J. Zobel.)
- Clifford Steven Snyder, Forestry
Greenbrier, Arkansas
- Dissertation: Sweetgum Seedling Growth and Endomycorrhizal Development as Affected by Soil Fumigation and Cover Crops. (Under the direction of Charles B. Davey.)
- Teresa Thomas Snyder, Psychology
Wilmington, North Carolina
- Dissertation: The Effects of Relaxation Training on the Behavior of Self-contained Emotionally Handicapped Children in the Public School Setting. (Under the direction of Rachel F. Rawls.)
- Harry John Strek, Crop Science
Fayetteville, North Carolina
- Dissertation: Improved Herbicide Rate Recommendations Using Soil and Herbicide Property Measurements. (Under the direction of Jerome B. Weber.)
- Ping-Liang Sue, Civil Engineering
Pingtung, Taiwan, Republic of China
- Dissertation: A Theoretical Investigation of Finitely Deforming F.C.C. Crystals in the Channel Die Compression Test. (Under the direction of Kerry S. Havner.)
- Kwangpyuk Suh, Materials Engineering
Seoul, Korea
- Dissertation: Microstructural Analysis of Deposited Thin Films of Refractory Metals on Gallium Arsenide Substrates after Annealing. (Under the direction of Khosrow L. Moazed.)
- Cheryl Busby Talbert, Forestry
San Juan Capo, California
- Dissertation: An Analysis of Several Approaches to Multiple-trait Index Selection in Loblolly Pine (*Pinus taeda* L.). (Under the direction of Robert C. Kellison and Floyd E. Bridgwater.)
- Roy Noriki Tamura, Statistics
Raleigh, North Carolina
- Dissertation: Minimum Hellinger Distance Estimation for Multivariate Location and Scatter. (Under the direction of Dennis D. Boos.)
- Tswen-Yung David Tang, Marine, Earth and Atmospheric Sciences
Taipei, Taiwan, Republic of China
- Dissertation: Topics on Equatorial Responses to Spatially and Temporally Varying Zonal Wind Stress. (Under the direction of Robert H. Weisberg and Gerald S. Janowitz.)

- Gary Arthur Taylor, Psychology
Dunn, North Carolina
Dissertation: A Construct Validity Study of Life Satisfaction, Self-actualization and Locus of Control. (Under the direction of Harold M. Corter.)
- Vernon Dean Toelle, Animal Science
Raleigh, North Carolina
Dissertation: Genetic Relationships between Testes Measurements and Female Reproductive Traits in Cattle and Swine. (Under the direction of O. Wayne Robison.)
- Judith Christopher Usanis, Psychology
Raleigh, North Carolina
Dissertation: The Relationship of the Neonatal Behavioral Assessment Scale and Maternal Perceptions of Fussiness to the Bayley Mental Scale and to Caretaking Choices. (Under the direction of Harold M. Corter.)
- Surendra Babu Vitta, Chemical Engineering
Bellary, India
Dissertation: Ion Exchange and Water Sorbent Materials Produced by Graft Copolymerization to Cellulose. (Under the direction of Edward P. Stahel and Vivian T. Stannett.)
- Stephen Paul Walker, Zoology
Palo Alto, California
Dissertation: Synchronization of Ecdysis in the Brachial Parasite *Probopyrus pandalicola* (Isopoda; Epicaridae; Bopyridae) and Its Host *Palaemonetes pugio* (Decapoda; Caridae; Palaemonidae). (Under the direction of Phyllis C. Bradbury.)
- Robert Willis Walters, Mechanical Engineering
Little Rock, Arkansas
Dissertation: Lu Methods for the Compressible Navier-Stokes Equations. (Under the direction of Hassan A. Hassan.)
- David W. Warren, Chemical Engineering
Durham, North Carolina
Dissertation: Monitoring High-temperature Structure Transformations in Reactive Solids Using Pulsed-gas Chromatography. (Under the direction of Amir Attar.)
- Nancy Leigh Yates, Horticultural Science
Jackson, Mississippi
Dissertation: Residue and Efficacy of Fluazifop-Butyl in Cucurbits (*Cucumis* sp.) and Sweet Potato (*Ipomoea batatas*). (Under the direction of Thomas J. Monaco.)
- Yih-Liang Yuan, Nuclear Engineering
Chiayi, Taiwan, Republic of China
Dissertation: A Monte Carlo Model for Neutron Capture Prompt Gamma-ray Analysis of Coal in Transmission Geometry. (Under the direction of Robin P. Gardner and Kuruvilla Verghese.)

ALUMNI DISTINGUISHED PROFESSORS

<i>Name</i>	<i>School and Department</i>	<i>Date</i>
George B. Blum, Jr.	Agriculture & Life Sciences Bio. & Ag. Engineering	1984-87
Joseph P. Hobbs	Humanities & Social Sciences History	1984-87
Michael Pause	Design	1984-87
Kuruville Verghese	Engineering Nuclear Engineering	1984-87

GRADUATE ALUMNI DISTINGUISHED PROFESSOR

Dr. William A. Jackson	Agriculture & Life Sciences Soil Science	1984-87
------------------------	---	---------

OUTSTANDING TEACHER AWARDS FOR 1983-84

<i>Name</i>	<i>School and Department</i>
David A. Barber	Physical and Mathematical Sciences Marine, Earth, and Atmospheric Sciences
Phyllis C. Bradbury	Agriculture and Life Sciences Zoology
James L. Cole	Education Psychology
Dario A. Cortes	Humanities and Social Sciences Foreign Languages and Literatures
Joseph M. Doster	Engineering Nuclear Engineering
Leon D. Freedman	Physical and Mathematical Sciences Chemistry
James D. Gregory	Forest Resources Forestry
Robert M. Grossfeld	Agriculture and Life Sciences Zoology
Charles K. Henrikson	Veterinary Medicine Anatomy, Physiological Sciences, and Radiology
Hiroko C. Kataoka	Humanities and Social Sciences Foreign Languages and Literatures
N. Paul Khosla	Engineering Civil Engineering
Carolyn R. Miller	Humanities and Social Sciences English
Gary N. Mock	Textiles Textile Chemistry
Jon F. Ort	Agriculture and Life Sciences Poultry Science
Clarence L. Smith, Jr.	Engineering Industrial Engineering

SCHOOL OF ENGINEERING

Engineering Senior Award for Scholarly Achievement: John M. Amein, Raleigh (Senior, Electrical and Computer Engineering)

Engineering Senior Award for Citizenship and Service: Janet J. Golio, Raleigh (Senior, Electrical and Computer Engineering)

Engineering Senior Award for the Humanities: Douglas A. Barnett, Morganton (Senior, Nuclear Engineering)

Engineering Senior Award for Leadership: Maria M. Sessoms, Sanford (Senior, Industrial Engineering)

Biological and Agricultural Engineering

Agricultural Council Outstanding Club Member Award for Biological and Agricultural Engineering—Science Curriculum: Patricia Joy Parker, Rocky Mount
American Society of Agricultural Engineers Student Honor Award—Student Branch of ASAE: Timothy James Lease, Raleigh

Chemical Engineering

Eastern North Carolina Section of AIChE Outstanding Senior Award: Mark A. Young, Cary

Chemical Engineering Senior Award for Outstanding Contributions to Chemical Engineering: Spero W. Calos, Jr., Charlotte

The Peter V. Danckwerts Senior Project Award: Mary A. Byard, Raleigh

Civil Engineering

American Society of Civil Engineers, The Outstanding Senior Award: James Harvey Dobbins, Greenville

American Society of Civil Engineers Senior Awards: Wesley Martin Lowder, Albemarle; Linda Anne Stacy, Berwyn, PA; Thomas Peter Ziegler, Asheboro

Associated General Contractors Award to Outstanding Senior in Civil Engineering/Construction Option: James B. Wyngaarden, Jr., Durham

Civil Engineering Outstanding Teaching Assistant Awards: Nouman Ali, Baghdad, Iraq; Donald A. Bryson, Charlotte; James Mark Sappington, Fayetteville

Electrical and Computer Engineering

Outstanding Senior Award: John Michael Amein, Raleigh

Outstanding IEEE Student Awards: Susan Mary Sierer, Ironton, Ohio; Clarence Vernon Roberts, Salisbury

Engineering Operations

Outstanding Senior Award: Jennifer Quick, Raleigh

J. W. Joseph Award: Benny Daryl Holbrook, Thurmond

Furniture Manufacturing and Management

Rudolph Willard Award, Outstanding Senior in Furniture Manufacturing and Management: David Lawrence Pollpeter, Normal, Illinois

Industrial Engineering

Outstanding Senior in Industrial Engineering: Sally Elizabeth Smith, Raleigh

Materials Engineering

Outstanding Senior Award: Laura Elizabeth Papa, Painted Post, New York

Mechanical and Aerospace Engineering

American Society of Mechanical Engineers Certificate of Award for Outstanding Student Member: Clifton A. McDonald, Sylva

American Institute of Aeronautics and Astronautics Outstanding Achievement Award: Richard A. Wahls, Raleigh

American Institute of Aeronautics and Astronautics Chairman Certificate: James R. Penley, Asheville

Nuclear Engineering

Outstanding Senior Award: Douglas A. Barnett, Morganton

SCHOOL OF FOREST RESOURCES

Biltmore Scholarships: Michael Oscar Gomez, Fayetteville; Scott Joseph Gordon, Cincinnati, OH; Jeffrey Lewis Lane, Charlotte; Nancy Lynne Martin, Beachwood, NJ; Keith P. Newcomer, Raleigh; Robert Allen Waddell, Jr., Fair Bluff; Jeffrey Lee Ward, Arden; Lori Ann Yedwabnick, Brentwood, NY

Ralph C. Bryant Scholarship Award: Nancy Lynne Martin, Beachwood, NJ

E. F. Conger Scholarship: Kimala Leigh Dills, Durham; Michael Joseph Kirchner, Aberdeen, MD

James L. Goodwin Award: Edward Hunter Birkhead, Cary; William Roy Cloninger, Bessemer City; Jeffrey David Guinn, Delmar, NY; Victor L. Harris, Raleigh; Stephen J. Paul, Cheverly, MD

Jonathan Wainhouse Memorial Scholarship Award: None

Southwest Forest Industries Award: Leslie Gaye Doss, Cary; Karen Papke Miller, Durham

George C. Slocum: Paul Gregory Davison, Kings Mountain

North Carolina Recreation and Parks Society Scholarship Award: William Stacy Barbour, Rocky Mount; James Allen Jones, Raleigh

Alonzo Aldrich Scholarship: Anthony J. Burnette, Canton

William E. Caldwell Scholarship: Steven L. Scheye, Pensacola, FL

Charles W. Coker, Sr., Scholarship: Jeffrey D. Murray, Winston-Salem

Continental Forest Industries Scholarship: Dana Wintzer, Woodbridge, VA

E. E. Ellis Scholarship: John S. Lovelady, Scottsboro, AL

R. G. Hitchings Scholarship: Jeffrey R. Reese, Raleigh

John R. Kennedy Scholarship: John E. Garnett, Greenwich, CT

Nalco Scholarship: Janis M. Johnson, Decatur, IL

Harry H. Saunders Scholarship: Medevick V. Byrd, Angier

Sture Olsson Scholarship: Richard P. Lehman, Monrovia, MD

Southeastern Paper Industry Management Association Award: Robert C. Blohm, Atlanta, GA

Stone Container Corporation Scholarship: James H. Caudill, Clemmons

Southern Paper Industry Management Association Award: Clinton D. Hester, Kernersville

Weyerhaeuser Foundation Endowed Scholarship: R. Arston Grant, Stone Mountain, GA

Showlin Family Scholarship: Grace G. Patton, Roanoke Rapids

Dwight J. Thomson Endowed Scholarship: Alan D. Moore, Canton

Carolina Canadian Lumber Sales Scholarship: Howard Brent Warren, Mebane

Weyerhaeuser Company Scholarships: Annette Fish Augustine, Raleigh; Sharon Ann Feldman, Fayetteville; Joseph Timothy Roberts, Raleigh

Wood and Paper Science Department Alumni Scholarship: Charles Neil O'Quinn, Jr., Kingstree, SC; Philip Edward Rosebrock, Cary

Thomas I. Hines Outstanding Senior in Recreation: Maureen Murphy, Charlotte; Amy Washburn, Charlotte

SCHOOL OF HUMANITIES AND SOCIAL SCIENCES

The School of Humanities and Social Sciences Highest Scholastic Achievement Award: Linda Claudette Rudisill (LAS)

Outstanding Senior Award: Diane Marie Kuhn (LEB)

SCHOOL OF PHYSICAL AND MATHEMATICAL SCIENCES

Department of Chemistry

The North Carolina Institute of Chemists' Outstanding Student Award: George Clyde McBane, Morganton

The Merck Index Award for Scholastic Achievement in Chemistry: Yvonne Maria Heinrich, York, PA

The CRC Press Freshman Chemistry Achievement Award: Melissa Ann Brewer, Elon College

Department of Computer Science

Menius Freshman Scholarship Award: Dorothy Marie Patterson, Wilson

The W. A. Brown Instruments, Inc. Senior Scholastic Achievement Award: Kyle Corbin, Raleigh

The W. A. Brown Instruments, Inc. Sophomore Scholastic Achievement Award: David Brown Caudle, Albemarle

Department of Mathematics

*Outstanding Senior in Mathematics:*Carolynn Alison Czynsz, Greensboro

Outstanding Junior in Mathematics: Keith Steven Promislow, Charlotte

Outstanding Sophomore in Mathematics: Patrick Chernesky, Bowie, MD

John Cell Scholarship: Carolynn Alison Czynsz, Greensboro; Dewey Dill Dellinger, Lincolnton

Carey Mumford Scholarship: Harold Russell Howell, Lumberton

Jack Levine Award: Timothy Brian Koonce, New Bern

Mary A. and Hubert V. Park Scholarship: Deborah Denise Hill, Jacksonville

Department of Marine, Earth and Atmospheric Sciences

J. M. Parker Field Camp Scholarship: Thomas Jay Berger, Raleigh; John Douglas Perry, Raleigh; Edward Harris Stephens, Raleigh

Department of Physics

Outstanding Graduating Senior in Physics: Paul Alan Carter, Eden

Department of Statistics

Outstanding Graduating Senior in Statistics: Michael George Lasher, Charlotte

SCHOOL OF TEXTILES

Joseph D. Moore Honor Award: A. John Beucus, Morganton

E. G. Howel Jones Honor Award: Patricia G. Arrowwood, Monroe

Harry Ball Honor Award: Penny Jo Bruce, Charlotte

Saul F. Dribben Memorial Award: Edgar L. Self II, Gastonia

Lawrence Iason Honor Award: Peter R. Sigmon, Newton

Harry Riemer Honor Award: Larry Grogan, Winston-Salem

Chester H. Roth Honor Award: Jeffrey N. Johnson, McLeansville

John M. Reeves Scholarship: Amie L. Jolley, Bostic

Textile Veterans Association Honor Award: Stephen E. Jenkins, Louisburg

John E. Reeves Award: Leigh Ann Moore, Salisbury

Donald F. McCullough Award: Bessie L. Howard, Clayton

John N. Gregg Award: Karen L. Forlidas, Charlotte

American Association of Textile Chemists and Colorists Award: Gregory A. Mills, Oakboro

Phi Psi Textile Fraternity Award: E. Ross Crews, Jr., Roxboro

American Association for Textile Technology Award: Lisa K. Hall, Walnut Cove

Sigma Tau Sigma Scholarship Fraternity Award: Susan G. Tobin, High Point

Kappa Tau Beta Student Leadership Award: Susan G. Tobin, High Point

Delta Kappa Phi Textile Fraternity Award: E. Todd Haley, Kannapolis

Henry A. Rutherford Honorary Award: Mary Catherine Eddy, Charlotte

The Dean's Award: John N. Gregg, Jr., Wayne, PA

ALUMNI ATHLETIC AWARD

Claudia Kreicker, Warsaw, IN

THE HONOR SOCIETY OF PHI KAPPA PHI

Awards for 1984:

Intellectual Achievement, Ph.D. Candidates: David E. Morris, Catherine E. Savinelli, Yih-Liang Yuan

Intellectual Achievement, Master's Candidate: Lloyd W. Massengill

Highest Scholastic Achievement—Seniors: Richard G. Cooper, Winthrop J. Schwab

Highest Scholastic Achievement—Juniors: Cheryl Brooks, Patricia M. Dukes, James M. Harrell, Kathleen M. Rau, Yun Suhr, Laura A. Winslow

Highest Scholastic Achievement—Sophomores: Robert C. Bolhm, Jodi M. Coble, Gary L. Gillespie, Catherine M. Gordon, Cynthia L. Hixon, Christie A. Hopkins, Eva C. Pickler, Christopher J. Riley, Rebecca D. Skaggs, Melanie C. Trull

GOLDEN CHAIN HONOR SOCIETY MEMBERS FOR 1983-84

Susan Aileen Brenimon
Michael Ralph Brasche
Medwick Vaughn Byrd, Jr.
Fred Anthony Caruso
Walter Stanley Gallagher
Susan Gaynelle Gossett
Patricia Carol Griffin
Bessie Lee Howard
Laura Elizabeth Papa
Rhonda Ruth Price
Sally Elizabeth Smith
Mark Tedder

AIR FORCE ROTC AWARDS

Air Force Association Award: Todd S. Ramsey, Hope Mills

American Legion—Military Excellence AS 400: Mark E. Skinner, Ft. Washington, MD

American Legion—Military Excellence AS 300: John B. White, Salemburg

American Legion—Military Excellence AS 200: Donald P. Duckett, Leicester

American Legion—Military Excellence AS 100: Deborah A. Crawford, Morehead City

American Legion—Scholastic Excellence AS 400: Robert J. Martin, Raleigh

American Legion—Scholastic Excellence AS 300: James N. Miller, Cary

American Legion—Scholastic Excellence AS 200: Michael T. Brewer, Raleigh

American Legion—Scholastic Excellence AS 100: Martin J. Carter, Winston-Salem

Daughters of the American Revolution Award: Barry M. Lineberger, Dallas

Daughters of Founders and Patriots of America Award: Sandra L. Walker, Bernardsville, NJ

Reserve Officers Association AS 400: Michael S. Williams, Basking Ridge, NJ

Reserve Officers Association AS 300: John B. White, Salemburg

Reserve Officers Association AS 200: Jeffrey E. Berthold, Greensboro

Military Order of the World Wars AS 400: Edgar F. Davis III, Kernersville

Military Order of the World Wars AS 300: Elizabeth A. Keck, Pope AFB

Military Order of the World Wars AS 200: Leo C. Adams, Andrews

Military Order of the World Wars AS 100: Marina Henderson, Washington

National Sojourners Award: Theresa L. Helm, Wilmington

General Dynamics Award: Douglas H. Welch, Charlotte

Sons of the American Revolution Award: David A. Koukol, Richmond, VA

American Defense Preparedness Association: James L. Ashworth, McAdenville

Air Force ROTC "Named" Scholarship Award: Neal C. Phillips, Bear Creek

ARMY ROTC AWARDS

Department of the Army Superior Cadet Awards: Charles K. Robinson, Charlotte; Alvin B. Starnes, Faith; Thomas A. Barber, Raleigh; James A. Clyburn, Raleigh

American Defense Preparedness Association Award: Don W. Sheets, Lexington

Association of the United States Army Award: Andrew V. Jasaitis, Fayetteville

Armed Forces Communications-Electronics Association Honor Certificate: Robert D. Collier, Raleigh

Reserve Officers' Association Award: Robert B. Rose, Carrsville, VA; Robert E. Sanders, Winston-Salem; James A. Clyburn, Raleigh

American Legion Award for General Military Excellence: Warren M. Casey, Raleigh; David A. Watts, Apex

American Legion Award for Scholastic Excellence: Thomas A. Barber, Raleigh;
Dolores M. Heib, Fayetteville

Veterans of Foreign Wars Award: William M. Maguire, Ford, VA

American Veterans of World War II, Korea, and Vietnam Award: Douglas R. Still,
Cary

National Sojourners Award: Sey S. Nam, Fayetteville

Sons of the American Revolution Award: Lorrie Overcash, Monroe

Military Order of the World Wars Award: Teresa L. Norris, Mars Hill; Joseph K.
Roberts, Havelock; Timothy S. Means, Kernersville; Douglas R. Still, Cary

Daughters of the American Revolution Award: Dolores Heib, Fayetteville

Daughters of Founders and Patriots Award: Mark D. Chapman, Junction City, OR
George C. Marshall Army ROTC Award Conference Representative/Winner:

Ventura Cuello (ECU), Greenville

*Braxton Bragg Chapter of the AUSA Award for the Outstanding Military History
Student:* Keith T. Krotish, Mebane

Braxton Bragg Chapter of the AUSA Award for the Outstanding Cadet: Jeffrey A.
Kelly, Weldon

Legion of Valor Bronze Cross Award: Thomas A. Barber, Raleigh

Society of the War of 1812 Award: Todd G. Kallem, Mayodan

Retired Officers Association Award: Marvin Connelly, Valdese

USAF ROTC Cadets Commissioned 1983-84

COMMISSIONED ON 10 JANUARY 1983

Jesse Ray Dillard, Jr. Goldsboro

COMMISSIONED ON 10 FEBRUARY 1983

Travis Eric Dawson, Jr. Raleigh

COMMISSIONED 12 MAY 1984

James L. Ashworth McAdenville
 *Kevin I. Bagatta Stonybrook, NY
 Walter R. Byrd Arden
 Edgar F. Davis Kernersville
 Boris DeLaine Charlotte
 Keith C. Felton Chesapeake, VA
 Robert M. Fuller, Sr. Wilmington
 *William C. Howard Winston-Salem
 Marc D. Johnson Asheville
 Barry Lineberger Dallas
 James F. Mallard Kinston
 Robert J. Martin Raleigh
 Michael W. May Cary
 *Kenneth Scott Murchison Lillington
 *Randall L. Riddle Mt. Airy
 Mark E. Skinner Ft. Washington, MD
 John W. Stillion Cullowhee
 Betsy C. Thomas Ellerbe
 John A. Toebes Virginia Beach, VA
 Waring Worsham Canton

TO BE COMMISSIONED IN AUGUST 1984

Stephen T. Hutchens Sanford
 William E. Martin Jackson

COMMISSIONED ON 21 DECEMBER 1983

Warren Evan Gool Goldsboro
 Tuan Anh Hoang Fayetteville
 Jimmie David Holmes Clayton
 Joseph Carl Kinney Bowie, MD
 Mark Allen Leonard Fayetteville
 Frank Collier McCall Raleigh
 Ailene Michike Surles Fayetteville
 *Raymond Joseph Warburton Greenville

* Distinguished Graduate

Army ROTC Cadets Commissioned 1983-1984

COMMISSIONED 12 MAY 1984

Alex T. Arlington	Durham
Jennifer Canney	Reykjavic, Iceland
James A. Clyburn	Raleigh
Robert D. Collier	Hillsborough
Arnold Foy	Fayetteville
Scott K. Jones	Benson
Keith T. Krotish	Mebane
Daniel C. Malone	West Long Beach
Robert S. McAlister	Asheboro
John N. Ogburn	Asheboro
Charles R. Peeler	Charlotte
Melody H. Rowley	Wendell
Charles L. Scarboro	Fayetteville
Don W. Sheets	Lexington
Douglas R. Still	Cary
Jeffery T. Toves	Fayetteville

TO BE COMMISSIONED 19 JULY 1984

Junius K. Maxwell	Pink Hill
David A. Watts	Apex

NORTH CAROLINA

Agricultural Institute



TWENTY-THIRD
COMMENCEMENT

University Student Center

North Carolina State University

May 11, 1984

T W E N T Y - T H I R D
A G R I C U L T U R A L I N S T I T U T E
E X E R C I S E S O F G R A D U A T I O N

School of Agriculture and Life Sciences

J. E. Legates, Dean
Presiding

May 11, 1984
2:00 p.m.

PROCESSIONAL

INVOCATION David C. Huffman
Minister
Trinity Presbyterian Church
Raleigh, North Carolina

ADDRESS Henry M. Simons, Jr.
Executive Director, Farm Credit Bank Services
Farm Credit Banks of Columbia
Columbia, South Carolina

AWARDING OF DIPLOMAS J. E. Legates, Dean
E. W. Glazener, Director of Academic Affairs
H. B. Craig, Associate Director of Academic Affairs
School of Agriculture and Life Sciences

REMARKS Bruce R. Poulton
Chancellor
North Carolina State University

RECOGNITION OF MARSHALS J. E. Legates, Dean

BENEDICTION David C. Huffman

RECESSIONAL

Reception Immediately Following the Graduation Ceremony

AGRICULTURAL INSTITUTE GRADUATES

May 11, 1984

AGRICULTURAL EQUIPMENT TECHNOLOGY

- * James Thomas Ellis, IV
- * Webster Sumner Irving
- ** # † Billy Mosley Kornegay, II
- Ashton Todd Lewis
- ** Dwight Phillip McDaniels
- Christopher Todd Naylor
- * † Mark Ellis Scronce

AGRICULTURAL PEST CONTROL

- ** Dorothy Kay Chandler
- Rex McArthur Lockamy
- Theodore Sidney Messer
- Gregory Scott Varnell

FIELD CROPS TECHNOLOGY

- * # James Warren Bissette, Jr.
- * # † Gary Lynn Blevins
- * Timothy Edward Bowes
- ** # Herbert Graham Cottle
- Tony Randolph Creech
- * # † Thomas Guthrie Gibson, III
- Daryl Eugene Glover
- * # Rodney Clarence Howard, Jr.
- Kenneth Randal Johnson
- Jeffrey Allen Lewis
- * # † Jesse Gill Preddy
- Lionel Tracy Price
- * Wesley N. Robbins
- * # † Timothy Shaw Sloan
- ** # † Jeffrey Davis Smith
- * # † Charles Richard Warner
- Travis Scott Wester
- Walter Wellington White, III
- Nathan Ernest Winslow

FLOWER AND NURSERY CROPS TECHNOLOGY

- Dudley Charles Baggett
- * Michael Glenn Furr
- ** Lynn Glasnapp Gaito
- ** Laura Kinsey Greene
- * # † Ashlee Allred Hedgecock
- * # † Tom Johnston Kearns, III
- ** Wanda Jean Morrison
- ** # † Shepherd Parks Parrish
- * # † Philip Sterling Strauss
- ** Gina Theresa Zangari

FOOD PROCESSING, DISTRIBUTION, AND SERVICE

- ** # † Christopher Lynn Austin
- George Randy Brock
- * # † William Jeffrey Childress
- Michael Adair Draughon
- Edward Keith Futrell
- ** Jeffery Lynn Gainey
- Sharon Denise Hunter
- Angeline Thorb Johnson
- * # † Buster Croom Morris
- Stanley Keith Mosley
- * # † James Keith Smith

GENERAL AGRICULTURE

- Gary Todd Aycoth
- Crofton D. Briscoe
- ** Chester Ray Cobb
- * Steven Karl Crouch
- Wayne Todd Harris
- Gregory Hilton Harrison
- * # Douglas Lionel Holt
- ** Thomas Wesley Rountree
- * # † Samuel Wheeler Worthington, III

LIVESTOCK MANAGEMENT AND TECHNOLOGY

/Cathy Sue Bounds
 # /Timothy James Caudill
 Alicia Lynn Elliott
 Michael Stephen Ferguson
 * Alton Gray Foster, Jr.
 Connie Dale Hampton
 * Douglas Wayne Holland
 Darrell Gene Hunsucker
 Andrew Nickell Hutchison
 # Russell Lynn Isley
 Thomas Melvin Jackson
 ** Neal Pharr Johnson
 James Mark Ligon
 # /Mark Gwyn Mathis
 Ralph Kent McClamroch
 # /Alan Bill Misenheimer
 # /Wanda Sherry Pittman
 # /Christopher Kent Randall
 Douglas Eugene Tallent
 * Joseph Wiggins Thompson
 ** Robert Graham Topp
 * Keith Alton Tuttle
 Charles Anderson Weaver, Jr.
 # /George Gainus Wilcox

TURFGRASS MANAGEMENT

Michael Lee Caudill
 ** # /George Anderson Cole
 Rory Boyd Ellington
 Alvis Orr Lassiter
 # /Rickey Linear Mobley
 * # /James Lyman Neely, Jr.
 ** Michael Anthony Ray
 # /Peter Daniel Ricciardi
 ** /Charles Dewey Robinson, Jr.
 ** William Jeffrey Robinson
 Jimmy Christopher Spell
 ** Michael James Thompson
 # Richard Walker Tufts

DOUBLE MAJORS

** Gregory O'Neil Annis
 John McCrimmon Calloway
 # Jeffrey Lee Cashwell
 Timothy Hugh Craig
 * # F. Carey Dail
 * Crandall Louis Fountain
 ** # Robert Lewis Gray
 Iris Leraime Howard
 # Stephen Dale Johnson
 Jonathan Harry Kirk
 * Robert James Millard
 Kevin Douglas Oakley
 Joseph Leroy Outlaw, Jr.
 * # /Gerald Scott Ross
 # /William Roland Tarkington
 Barry Stephen Tarleton
 /Randall Scott Turner
 ** Ronnie Franklin Wrenn

** High Honors

* Honors

/ In Absentia

Graduated December, 1983

MARSHALS

Gary Edward Milton

Neil Bennett Covington, Jr.

Benjamin Thomas Jarratt

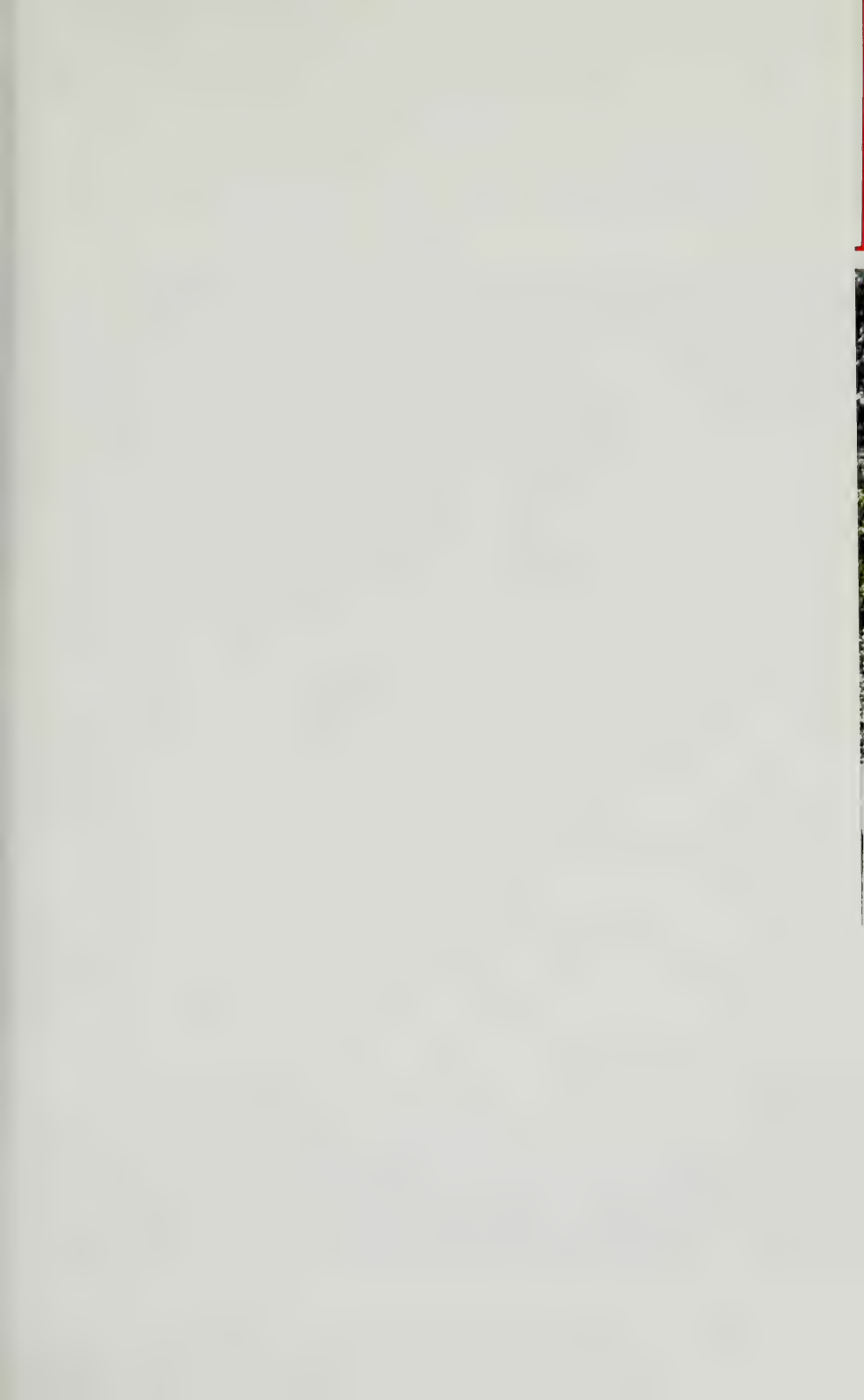
Edward Carlton Garner, III

Chester Bryan Hooten

Jimmy Lloyd Thomas

Gregory Stuart Beam

Delane Marie Isley





February 1984

North Carolina State University **Bulletin**



summer sessions 1984

DEFINITIONS OF ETHNIC GROUPS

White (not of Hispanic origin). Persons having origins in any of the original peoples of Europe, North Africa, or the Middle East.

American Indian or Alaskan Native. Persons having origins in any of the original peoples of North America, and who maintain cultural identification through tribal affiliation or community recognition.

Black (not of Hispanic origin). Persons having origins in any of the black racial groups.

Asian or Pacific Islander. Persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands. This includes for example, China, Japan, Korea, the Philippine Islands, American Samoa.

Hispanic. Persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race.



SUMMER SESSIONS 1984
North Carolina State University
Raleigh, North Carolina

SUMMER SESSIONS 1984

REGISTRATION APPLICATION

INFORMATION

STUDENTS ELIGIBLE TO USE THE ENCLOSED SUMMER SESSIONS REGISTRATION APPLICATION:

Only lifelong education students are eligible to use the enclosed Summer Session Registration Application.

The registration application form *must* be used by all visiting students from other colleges or universities who will be classified as *lifelong education students* and by all students who are currently classified as lifelong education students at North Carolina State University.

A *lifelong education student* is one who has not been formally admitted as a degree candidate to North Carolina State University and does not wish regular classification of any kind at the University. See page 10, Lifelong Education Students, for additional information.

NOTE: All lifelong education students (including those from other universities and colleges) are advised that NCSU degree students are always given priority for Summer Sessions classes. *Acceptance of the Registration Application for lifelong education students by the Summer Sessions Office in no way constitutes a guarantee that class space will be available.*

STUDENTS NOT ELIGIBLE TO USE THE ENCLOSED SUMMER SESSIONS REGISTRATION APPLICATION:

1. The registration application form is *not* to be used by any classified degree candidate, undergraduate or graduate, now attending North Carolina State University. Such students must preregister through their advisers (see page 13).
2. The registration application form is *not* to be used by any student who has previously enrolled as a degree candidate at North Carolina State University. Such students (former students returning) must apply for readmission to the University by writing to the Department of Registration and Records, North Carolina State University, Box 7313, Raleigh, North Carolina 27695-7313 (see page 13).

INFORMATION:

For additional information about the Summer Sessions write to:

The Director of Summer Sessions
North Carolina State University
Box 7401
Raleigh, N.C. 27695-7401

or call (919) 737-2265.

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NORTH CAROLINA STATE UNIVERSITY

ADMINISTRATION

Bruce R. Poulton, *Chancellor*

Nash N. Winstead, *Provost and Vice Chancellor*

William L. Turner, *Vice Chancellor for Extension and Public Service*

Thomas H. Stafford Jr., *Interim Vice Chancellor for Student Affairs*

George L. Worsley, *Vice Chancellor for Finance and Business*

Rudolph Pate, *Vice Chancellor for Foundations and University Relations*

Jasper D. Memory, *Vice Provost and Dean of the Graduate School*

Franklin D. Hart, *Assistant Vice Chancellor for University Research*

DEANS OF THE SCHOOLS

J. Edward Legates, *School of Agriculture and Life Sciences*

Claude E. McKinney, *School of Design*

Carl J. Dolce, *School of Education*

Larry K. Monteith, *School of Engineering*

Eric L. Ellwood, *School of Forest Resources*

Robert O. Tilman, *School of Humanities and Social Sciences*

Garrett Briggs, *School of Physical and Mathematical Sciences*

Dame S. Hamby, *School of Textiles*

Terrence M. Curtin, *School of Veterinary Medicine*

SUMMER SESSIONS

William L. Turner, *Vice Chancellor for Extension and Public Service*

John F. Cudd, Jr., *Director*

Denis S. Jackson, *Assistant Director*

ADMISSIONS

Anna P. Keller, *Director*

REGISTRATION

James H. Bundy, *University Registrar*

SUMMER SESSION CALENDARS

1984

FIRST SESSION (MAY 22-JUNE 28)

May 22	Tuesday	Registration Day
May 23	Wednesday	First day of classes
May 24	Thursday	Last day to add a course without permission of instructor
May 28	Monday	Last day to add a course; last day to withdraw or drop a course with a refund (NOTE: The tuition and fees charge is based on the number of hours and courses officially carried as of this date.)
June 1	Friday	Last day to withdraw or drop a course without a grade, or to change from credit to audit, at the 400 level or below
June 8	Friday	Last day to withdraw or drop a course at the 500 or 600 level without a grade
June 26	Tuesday	Last day of classes
June 27, 28	Wednesday, Thursday	Final examinations

FIRST SESSION FINAL EXAM SCHEDULE

Examination Times	0800-1100	1300-1600	1800-2100
	Hour Class Actually Begins During the Session		
Wednesday, June 27	0730, 0800, 0910	1140	1745
Thursday, June 28	0950, 1020	1300, 1340	1915, 1945

SECOND SESSION (JULY 5-AUGUST 10)

July 5	Thursday	Registration Day
July 6	Friday	First day of classes
July 9	Monday	Last day to add a course without permission of instructor
July 11	Wednesday	Last day to add a course; last day to withdraw or drop a course with a refund (NOTE: The tuition and fees charge is based on the number of hours and courses officially carried as of this date.)
July 17	Tuesday	Last day to withdraw or drop a course without a grade, or to change from credit to audit, at the 400 level or below
July 24	Tuesday	Last day to withdraw or drop a course at the 500 or 600 level without a grade
August 9	Thursday	Last day of classes
August 10	Friday	Final examinations

SECOND SESSION FINAL EXAM SCHEDULE

Examination Times	0800-1100	1300-1600	1800-2100
	Hour Class Actually Begins During the Session		
Friday, August 10	0730, 0800, 0910	0950, 1020	1140 or later

TEN-WEEK SESSION (MAY 22-AUGUST 8)

May 22	Tuesday	Registration Day
May 23(24)*	Wednesday (Thursday)	First day of classes
May 28(29)*	Monday (Tuesday)	Last day to add a course without permission of instructor
June 6(7)*	Wednesday (Thursday)	Last day to add a course; last day to withdraw or drop a course with a refund (NOTE: The tuition and fees charge is based on the number of hours and courses officially carried as of this date.)
June 13(14)*	Wednesday (Thursday)	Last day to withdraw or drop a course without a grade, or to change from credit to audit at the 400 level or below
June 18(19)*	Monday (Tuesday)	Last day to withdraw or drop a course at the 500 or 600 level without a grade
July 4	Wednesday	Holiday
July 31	Tuesday	Last day of classes for Tuesday/Thursday classes
August 1	Wednesday	Last day of classes for Monday/Wednesday classes
August 2	Thursday	Final examinations for 1745 Tuesday/Thursday classes
August 6	Monday	Final examinations for 1745 Monday/Wednesday classes
August 7	Tuesday	Final examinations for 1915, 1945 Tuesday/Thursday classes
August 8	Wednesday	Final examinations for 1915, 1945 Monday/Wednesday classes

* First date for Monday/Wednesday classes. Date in parentheses for Tuesday/Thursday classes.

ADULT EDUCATION SESSION (JULY 9-JULY 27)

July 9	Monday	First day of classes
July 10	Tuesday	Last day to add a course without permission of instructor
July 12	Thursday	Last day to add a course; last day to withdraw or drop a course with a refund (NOTE: The tuition and fees charge is based on the number of hours and courses officially carried as of this date.)
July 18	Wednesday	Last day to withdraw or drop a course without a grade
July 26	Thursday	Last day of classes
July 27	Friday	Final examinations



Prominent in the above aerial of the central North Carolina State University campus are three high-rise residence halls (foreground), the circular Harrelson Hall with the adjacent towers of Cor and Dabney Halls, and in the upper left, the tower of the D. H. Hill Library. The central campus encompasses some 623 acres.

North Carolina State University

North Carolina State University is one of the nation's major public universities and shares the distinctive character of Land-Grant state universities nationally—broad academic offerings, extensive public service, national and international activities, and large-scale extension and research programs.

The University is organized in nine schools and the Graduate School. The nine schools are Agriculture and Life Sciences, Design, Education, Engineering, Forest Resources, Humanities and Social Sciences, Physical and Mathematical Sciences, Textiles, and Veterinary Medicine. In addition, a complex of divisions, institutes, and centers provides for a wide range of special academic, research, and extension programs.

Academic opportunities are provided in 87 fields leading to baccalaureate

degrees, 100 master's degree programs and 47 doctoral programs.

Research activities span a broad spectrum of about 700 scientific, technological and scholarly endeavors.

Extension work on a statewide basis in each of the 100 counties carries the University's campus to the state's boundaries. Diverse extension activities are carried on by all nine schools and a number of specialized institutes and centers.

The University has approximately 5,500 employees. There are 2,400 faculty and other academic personnel, including 1,300 graduate faculty and 200 adjunct faculty.

There are 140 campus buildings on the central campus of 623 acres. In addition the University has 88,000 acres on a statewide basis, including one research and endowment forest of 78,000 acres. Near the main campus are research farms; biology and ecology sites; genetics, horticulture, and floriculture nurseries; forests; and areas such as Carter-Finley Stadium, which together comprise about 2,500 acres.

The University's Wolfpack athletic teams are well-known nationally. The basketball team was national champion in 1974 and 1983. The football team has been the Atlantic Coast Conference champion five times and co-champion twice and has won five bowl games. Numerous N. C. State athletes have won NCAA, national, and international honors, including medals in the last four Olympic Games in which the United States has competed. The Wolfpack women's intercollegiate cross-country team won national championships in 1979 and 1980. An N. C. State woman was the first woman to win the coveted ACC "Athlete of the Year" award in 1980, and she won it again in 1981 for her performances in distance running. A Wolfpack athlete won the first women's NCAA individual cross-country championship in 1981. The women's basketball and swimming teams also have ranked nationally.

North Carolina State University is one of the three Research Triangle Universities along with Duke University and the University of North Carolina at Chapel Hill. In the 30-mile triangle formed by the three universities is the 5,000-acre Research Triangle Park, the Research Triangle Institute (a Universities' subsidiary), and the Triangle Universities Computation Center, a central facility for the extensive computing activities of the institutions.

N. C. State's enrollment reached more than 22,600 in the 1983 fall semester. There are 16,200 students in undergraduate degree programs, 3,150 in graduate degree programs, and more than 3,250 lifelong education students in various categories. The total student population includes approximately 1,800 black and 600 other minority students, 8,100 female students, and 5,764 students twenty-five years of age or older. Students at State come from 49 states and 89 countries. The international enrollment is a distinctive feature of the institution since its more than 800 international students give it a decidedly cosmopolitan atmosphere.

North Carolina State University is committed to equality of educational opportunity and does not discriminate against applicants, students, or employees based on race, color, national origin, religion, sex, age, or handicap. Moreover, North Carolina State University is open to people of all races and actively seeks to promote racial integration by recruiting and enrolling a larger number of black students.

NCSU is a member of the National Association of State Universities and Land-Grant Colleges, the American Council on Education, and the American Council of Learned Societies.

THE SUMMER SESSIONS

The Summer Sessions at North Carolina State University offer an extensive educational program planned to meet the varied needs and interests of over 13,000 students. Over sixty departments offer instruction in more than 700 courses, approximately 60% of which are at the undergraduate level.

Each of the University's nine schools, with a combined faculty of more than 400, participates in the Summer Sessions. The schedule includes two "regular" five-week sessions, a ten-week session, and a three-week institute for adult and extension educators, as well as several dozen evening courses scheduled for the convenience of working adults.

Summer courses and special programs are designed for the new student, the undergraduate wanting to advance his or her academic standing at State, the graduate desiring to continue study and research during the summer months and for visiting students pursuing degrees at other institutions. Teachers who need to earn credit toward renewal of teaching certificates or advanced degrees in education and persons in professional fields who wish to keep abreast of new developments and trends also take advantage of State's summer programs.

ADMISSIONS

North Carolina State University is committed to equality of educational opportunity and does not discriminate against applicants, students, or employees based on race, color, national origin, religion, sex, age, or handicap. Moreover, North Carolina State University is open to people of all races and actively seeks to promote racial integration by recruiting and enrolling a larger number of black students.

Students are admitted to the summer sessions in one of seven categories: 1) new freshmen, 2) new undergraduate transfer students, 3) new graduate students, 4) lifelong education students, 5) continuing North Carolina State University students, 6) former North Carolina State University students, 7) suspended North Carolina State University students.

NEW FRESHMEN

Application forms for new freshmen should be obtained from the Director of Admissions, Peele Hall, NCSU, Box 7103, Raleigh, North Carolina 27695-7103. The Summer Sessions application form in this bulletin should *not* be completed. Applications should be submitted in the fall of the senior year in high school. The application deadline is May 1. Based on past experience, applications and credentials received in the fall and early winter have received full consideration while those applications received later may be subject to a waiting list.

A freshman applicant should be a graduate of an accredited secondary school. Nongraduates should have a high school equivalency certificate. The following high school preparation, or its equivalent, is necessary: English, 4 units; history or social studies, 2 units; mathematics, 2 units in algebra, 1 unit in geometry, and 1 unit in advanced math is strongly recommended for the Schools of Engineering, Physical and Mathematical Sciences, and Forest Resources; science, 2 units, preferably biology, chemistry, or physics; foreign language, 2 units recommended but not required, for the School of Humanities and Social Sciences only.

Freshman applicants must take the Scholastic Aptitude Test of the College Entrance Examination Board. These scores, together with the high school record, will be considered in determining admissibility. Information as to the time and place at which the Scholastic Aptitude Test will be given may be obtained from high school

guidance counselors, or by writing directly to the College Entrance Examination Board, Box 592, Princeton, New Jersey 08540 for the *Bulletin of Information*. The *Bulletin* includes an application form and is available without charge. Test scores from the ACT (American College Test) may be submitted in lieu of the SAT.

Although the Achievement Test scores are not used in the admission decision, the English and Math Level I Tests are recommended for proper course placement. Additional information concerning these tests may be obtained by contacting the Undergraduate Admissions Office (919-737-2434).

NEW TRANSFER STUDENTS

In addition to submitting an application form which may be obtained from the Director of Admissions, Peele Hall, before May 1, all transfer students must have official transcripts sent to the Admissions Office directly from each institution attended. The Summer Sessions application in this bulletin should *not* be completed.

A transfer student should present at least 28 semester hours of satisfactory (C or better) college-level work with a minimum overall 2.0 (C) average on all college work attempted and be eligible to return to the last institution regularly attended. *Programs that are experiencing space limitations require a higher minimum grade point average for admission.* Students presenting fewer than 28 semester hours must also meet the admissions requirements for entering freshmen by having the high school record and SAT or ACT scores submitted. Individual official transcripts must be submitted from each institution attended. The college credits must have been earned at an accredited institution and should include a college-level math or the high school record must be submitted to show proper background.

NEW GRADUATE STUDENTS

All students working towards advanced degrees are enrolled in the Graduate School. An application for admission may be obtained from the Dean of the Graduate School, Peele Hall, Box 7102, NCSU, Raleigh, North Carolina 27695-7102.

STUDENTS ADMITTED TO THE FALL SEMESTER

Any student accepted for regular admission for the fall semester wishing to attend either summer session should notify the Admissions Office, Peele Hall, to change the date of entrance. He or she should *not* complete a Summer Sessions application.

LIFELONG EDUCATION STUDENTS

Lifelong education students must complete the Summer Sessions Registration Application in the front of this bulletin. A lifelong education student is one who has never been formally admitted as a degree candidate at North Carolina State University. All students visiting from other schools will be classified as lifelong education students.

Lifelong Education Students—Undergraduate Studies (UGS)—This classification is used for individuals who have not obtained a baccalaureate degree and who wish to take courses but who are not currently admitted to a degree program. To be eligible for acceptance as an Undergraduate Lifelong Education Student, for the Summer Sessions an individual should:

- a. have acquired a high school diploma or GED certificate; and
- b. not be a degree candidate at North Carolina State University; or
- c. be a high school student who has been recommended by his/her school and approved by the Office of Admissions to take lower level courses.

Post-Baccalaureate Studies (PBS)—The Post-baccalaureate Studies (PBS) classification is designed for U.S. citizens who wish to undertake academic work beyond the baccalaureate degree but who are not currently admitted to a degree program. This classification is not open to foreign nationals with the exception of the spouse of a regularly enrolled NCSU student. In special cases where students are sponsored by an agency of the U. S. government for specialized, non-degree study, approval may be given by the Graduate School for registration in the Post-Baccalaureate Studies classification. The following policies apply to students who wish to register for PBS:

1. All must have baccalaureate degrees from accredited institutions of higher education.
2. All classes taken for credit by PBS students will be graded in the usual manner that applies for the particular course (A, B, C, D, NC, or S, U). All courses taken at NCSU will show on the student's transcript. If the student is admitted as a graduate student, a maximum of nine hours may apply toward the minimum requirements of the degree for which the student is enrolled. Only the *first* nine hours of course work taken at the graduate level in the PBS category can be accepted toward degree requirements unless a request for some other combination of nine hours is made by the student's advisory committee and approved both by the School Dean and the Graduate Dean.
3. The Grade Point Average (GPA) of a graduate student who has credits in the PBS category will be based on all courses taken at the 400-600 level. However, no course taken six (6) years prior to enrollment into a program will be considered in the GPA calculation.
4. Registration is limited to a maximum of two courses per semester. Individuals who are employed fulltime should limit their PBS registration to one course per semester.
5. The PBS classification carries with it no implication that the student will be admitted to the Graduate School in any degree classification.
6. PBS students are expected to familiarize themselves with Graduate School policies and to seek further advice or clarification as needed.

Limitations—Persons found eligible to study as lifelong education students are not to assume that they have received formal admission to the University as either undergraduate or graduate degree candidates. To become a degree candidate, formal application must be made through the Undergraduate Admissions Office or the Graduate School. Undergraduate lifelong education students may not register for more than seven credit hours in a summer session.

Course Availability—Persons found eligible may register for any course offered by the University, provided they satisfy the required course prerequisites and classroom space is available.

Academic Standards—The academic standards applicable to undergraduate candidates at the University will apply to lifelong education students.

CONTINUING NCSU DEGREE STUDENTS

Any regular NCSU degree candidate may attend the Summer Sessions. *The Summer Sessions application in this bulletin must not be completed*, but registration procedures as listed on page 13 must be followed.

READMISSION OF FORMER NCSU DEGREE STUDENTS

Former NCSU degree students who wish to attend the Summer Sessions must apply for readmission through Registration and Records at least 30 days prior to the intended date of return. The readmission application may be obtained by writing to the Department of Registration and Records, NCSU, Raleigh, N.C. *The Summer Sessions application in this bulletin must not be completed*, but registration procedures as listed on page 13 must be followed.

SUSPENDED NCSU DEGREE STUDENTS

NCSU degree students suspended at the end of the spring semester, 1984, may attend one or both sessions of the Summer Sessions to become eligible to continue in the fall. *The Summer Sessions application in this bulletin must not be completed*, but registration procedures as listed on page 13 must be followed. Students suspended prior to the spring semester, 1984, may attend one or both sessions of the Summer Sessions but should follow readmission procedures. The readmission application may be obtained by writing the Department of Registration and Records, NCSU, Box 7313, Raleigh, N.C. 27695-7313.



Poe Hall which houses the School of Education . . .

REGISTRATION PROCEDURES

PREREGISTRATION

All students who plan to attend the Summer Sessions must preregister. Preregistration consists of selecting the courses to be taken during the Summer Sessions and filing a Preregistration Schedule Request Form with Registration and Records. Each student who preregisters will be allowed to *complete registration by mail* if tuition and fees have been paid by the deadline. The preregistration period for all students will begin on Monday, March 26, 1984. The deadlines for preregistration will be:

First Summer Session and the Ten-Week Session—Friday, April 6, 1984

Second Summer Session and the Adult Education Session—Thursday, May 17, 1984

Currently enrolled degree students will preregister for the Summer Sessions at the time they preregister for the 1984 fall semester.

Former degree students returning may preregister for the Summer Sessions after they have filed an application for readmission and have received their letters of approval.

New Freshmen and new transfer degree students may preregister for the Summer Sessions after they have received their letter of approval. New students who desire to attend the Summer Sessions should contact the Admissions Office.

Lifelong Education (non-degree) students will preregister for the Summer Sessions by completing the Summer Sessions Registration Application in the front of the Summer Sessions Bulletin and filing this with the Summer Sessions Office by mail or in person.

REGISTRATION BY MAIL FOR ALL PREREGISTERED STUDENTS

All students (undergraduate degree, graduate degree, and lifelong education (non-degree) students) who have preregistered will complete registration by mail if tuition and fees have been paid by the deadlines:

First Summer Session and the Ten Week Session—Tuesday, May 8, 1984

Second Summer Session and the Adult Education Session—Thursday, June 21, 1984

No class schedule will be mailed if tuition and fees are not paid in full by these deadlines. Class schedules will be mailed approximately one week prior to the beginning of classes to the student's mailing address. It is *very important* that all students notify the Department of Registration and Records of any address changes. Class schedules returned to the Department of Registration and Records by the Postal Service because of improper addresses, or class schedules not mailed because of a University "HOLD" (see "HOLDS" on class schedules) must be picked up at Reynolds Coliseum on Registration Day from 8:30 a.m. to 12:00 noon:

First Summer Session and the Ten Week Session—Tuesday, May 22, 1984

Second Summer Session and the Adult Education Session—Thursday, July 5, 1984



Changing classes . . .

If your class schedule has not been picked up by 12:00 noon, your class schedule will be cancelled (see Cancellation Policy below).

CANCELLATION POLICY

All students (graduate, undergraduate and lifelong education) must complete registration and obtain their class schedules by Registration Day if the class schedule is not mailed because of a University "HOLD" or returned because of an improper address:

First Summer Session and the Ten Week Session—Tuesday, May 22, 1984

Second Summer Session and the Adult Education Session—Thursday, July 5, 1984

CLASS SCHEDULES NOT PICKED UP BY THESE DATES WILL BE AUTOMATICALLY CANCELLED AFTER 12:00 NOON.

"HOLDS" ON REGISTRATION

Students who have not cleared their tuition and fees and/or other outstanding accounts with the University Cashier's Office by the payment deadlines indicated below will have a "HOLD" placed on their class schedule. Payments must be cleared in order to complete registration. Students who have a "HOLD" placed on their class schedule will be mailed a "HOLD NOTICE" instead of their class schedule. Students must present this notice to the University Cashier's table in Reynolds Coliseum on Registration Day to be cleared for registration. Failure to present the notice may prevent students from picking up their class schedule on Registration Day. The University Cashier's table will stamp the "HOLD NOTICE"

when all holds have been cleared. Students should then present the cleared "HOLD NOTICE" to the Schedule Hold tables also located in Reynolds Coliseum on Registration Day to pick up their class schedule. Any student (graduate, undergraduate and lifelong education) unable to clear his/her "HOLD" and pick up his/her class schedule must obtain permission from the University Cashier's table to avoid having his/her class schedule cancelled.

PAYMENT DEADLINES

First Summer Session and the Ten Week Session—May 8, 1984

Second Summer Session and the Adult Education Session—June 21, 1984

REGISTRATION FOR NON-PREREGISTERED STUDENTS

All students will report to Reynolds Coliseum with a "Permit to Register". The "Permit to Register" may be obtained at the appropriate office according to the following categories:

Continuing Degree Students (students who were registered or withdrew during the 1984 spring semester)—Report to Room 100, Harris Hall, and request a "Permit".

Re-entering Degree Students (students who previously attended NCSU but were not enrolled during the 1984 spring semester)—Report to Room 100, Harris Hall, complete a Readmission Application and obtain a "Permit".

New Undergraduate Degree Students (never attended NCSU)—Report to the Admissions Office, 107 Peele Hall and obtain a "Permit".

New Graduate Degree Students (never attended NCSU)—Report to the Graduate Office, 104 Peele Hall and obtain a "Permit".

Lifelong Education Students (non-degree)—Report to the Division for Lifelong Education, McKimmon Center and complete a Lifelong Education Student Application Form. The application will serve as a "Permit" when properly marked by the Division for Lifelong Education.

All students will be admitted to the Coliseum from 8:30 a.m. to 12:00 noon on the Registration dates indicated below:

First Summer Session and the Ten Week Session—May 22, 1984

Second Summer Session and the Adult Education Session—July 5, 1984

WITHDRAWAL FROM THE UNIVERSITY

A regularly enrolled student who finds it necessary to drop all courses will initiate withdrawal from the University at the Counseling Center, 200 Harris Hall. A lifelong education student in the same circumstance initiates withdrawal from the University at the Summer Sessions Office, McKimmon Center, Gorman Street and Western Boulevard. A student who withdraws will not have any grades recorded. A student who discontinues attending classes without officially withdrawing will receive all "NC" grades.

After a short period (four days) during which it is possible to withdraw with a refund of fees (less a registration fee), there is a period during which a student may withdraw but without refund. The withdrawal deadline for undergraduates

(regularly classified and Undergraduate Lifelong Education students) corresponds to the last day to drop a course at the 400-level or below; for graduate students (including Post-Baccalaureate students) the deadline for withdrawal corresponds to the last day to drop 500- or 600-level courses. (See the appropriate Summer Sessions Calendar for dates.) After the published deadlines, there is no withdrawal except for unusual circumstances which can be documented as, for example, extended illness. Under these circumstances a student may petition the *Fee Appeals Committee* for a prorated refund of tuition and fees.

SPECIAL NOTES

1. Tuition and fees are payable by check or cash before or on the day of registration. Advanced billing of tuition and fees will be made *only* for those students who preregister. Payment is requested by May 8, 1984 for the first summer session and ten-week session and June 21, 1984 for the second summer session and the adult education session.
2. Students planning to take courses in both sessions should plan their sequences well in advance. Offerings in the second session are often substantially less in number than in the first session, and in many instances, departments do not offer courses in both summer sessions.
3. Everything possible will be done to insure that the courses listed in this bulletin will be given at the time indicated. *However, the Director of Summer Sessions reserves the right to cancel courses in which enrollment is deemed insufficient.*
4. The normal load for either session of the Summer Sessions is six or seven hours for undergraduates and six hours for graduates. Any student may carry less. Regularly enrolled students who desire to carry *more* than seven hours must obtain the approval of the Dean or Director of Instruction of the school in which they are enrolled. Students visiting from other schools who wish to take more than seven hours must obtain the approval of the Director of Summer Sessions.
5. *All lifelong education students (including those from other universities and colleges) are advised that NCSU degree students are always given priority for Summer Sessions classes. Acceptance of the Registration Application for lifelong education students by the Summer Sessions Office in no way constitutes a guarantee that class space will be available.*

NONDISCRIMINATION POLICY

North Carolina State University is dedicated to equality of opportunity within its community. Accordingly, North Carolina State University does not practice or condone discrimination, in any form, against students, employees, or applicants on the ground of race, color, national origin, religion, sex, age, or handicap. North Carolina State University commits itself to positive action to secure equal opportunity regardless of those characteristics.

North Carolina State University supports the protection available to members of its community under all applicable Federal laws, including Titles VI and VII of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, Sections 799A and 845 of the Public Health Service Act, the Equal Pay and Age Discrimination Acts, the Rehabilitation Act of 1973, and Executive Order 11246. For information concerning these provisions, contact:

Dr. Lawrence M. Clark
 Assistant Provost and University Affirmative Action Officer
 Box 7101
 North Carolina State University
 Raleigh, North Carolina 27695-7101
 Phone: (919) 737-3148

ACADEMIC REGULATIONS

North Carolina State University's grading system for measuring academic achievement which became effective the fall semester, 1976, is:

DEFINITION OF LETTER GRADES AND GRADE POINTS

<i>Grade</i>	<i>Definition</i>	<i>Grade Points Per Credit Hour</i>
A	Excellent	4
B	Good	3
C	Satisfactory ("Passing" for graduate students)	2
D	Marginal	1
NC	No Credit	0

The following grades are not used in the calculation of grade point averages.

GRADE DEFINITION

- S Satisfactory (Credit-only and certain other courses)
- U Unsatisfactory (Credit-only and certain other courses)
- CS Satisfactory (for certain PBS students only)
- CU Unsatisfactory (for certain PBS students only)
- CR Credit by Examination or Advanced Placement
- IN Incomplete
- LA Temporarily Late
- AU Audit
- NR No Recognition Given for Audit

Questions concerning this grading system should be directed to James H. Bundy, University Registrar, NCSU, Box 7313, Raleigh, N.C. 27695-7313.

EXPENSES

TUITION AND FEES RATE SCHEDULE—1984 SUMMER SESSIONS

Undergraduates

Residents of North Carolina				Nonresidents			
<i>Hours</i>	<i>Tuition</i>	<i>Required Fees</i>	<i>Total</i>	<i>Hours</i>	<i>Tuition</i>	<i>Required Fees</i>	<i>Total</i>
1-5	\$ 66	\$50	\$116	1-5	\$274	\$50	\$324
6+	132	50	182	6+	548	50	598

Graduate Students

<i>Hours</i>	<i>Tuition</i>	<i>Required Fees</i>	<i>Total</i>	<i>Hours</i>	<i>Tuition</i>	<i>Required Fees</i>	<i>Total</i>
0-Thesis	\$ 55	\$ 6	\$ 61	0-Thesis	\$126	\$ 6	\$132
1-5	88	50	138	1-5	364	50	414
6+	176	50	226	6+	729	50	779

School of Veterinary Medicine

<i>Hours</i>	<i>Tuition</i>	<i>Required Fees</i>	<i>Total</i>	<i>Hours</i>	<i>Tuition</i>	<i>Required Fees</i>	<i>Total</i>
1-5	\$196	\$50	\$246	1-5	\$449	\$50	\$499
6+	392	50	442	6+	900	50	950



The University Plaza, one of the busiest areas on campus is dominated by the tower of the D. H. Hill Library. The library's collection numbers more than one million volumes.

SPECIAL REGISTRATION AND FEES

- A. Thesis Preparation (GR 598 or GR 698), Dissertation Research (GR 697), Examination Only (GR 597), and Summer Research (GR 596S or GR 696S) are all charged the 0-Thesis rate.
- B. Cooperative Education Fee\$51
- C. Audits Rates same as for credit

Note: The tuition and fees charge is assessed according to the total hours and courses carried as of 5:00 p.m. on:

- Monday, May 28, 1984, for the first summer session.
- Thursday, June 7, 1984, for the ten-week session.
- Wednesday, July 11, 1984, for the second summer session.
- Thursday, July 12, 1984, for the adult education session.

* Tuition and fees for the 1984 summer sessions are tentative rates and are subject to change.

NOTICES

1. A statement of tuition and fees is mailed to each preregistered student around 20-30 days before the beginning of each summer session. The statement must be returned with full payment or complete financial assistance information by May 8, 1984 for the first summer session and the ten-week session and by June 21, 1984 for the second summer session and adult education session. Nonpreregistered students are required to pay tuition and fees at registration. Deferred payments will not be allowed during the summer sessions.
2. Required fees are included in the rates listed above and must be paid by all students. Students are entitled to the services, facilities, and programs offered by the Student Center, Health Services, Physical Education Department, and Athletics Department. An itemization of required fees will be provided upon request.
3. Upon adding course work that results in an increased fee, students should pay at the Coliseum on Registration Day and at 2 Peele Hall thereafter. Refunds resulting from courses dropped can be obtained by presenting the official drop form at 2 Peele Hall.
4. All students enrolled in courses designated as requiring student use of University, School, or Departmental computing resources during class or laboratory sessions or as homework assignments will be charged a computer course fee of \$15 per summer session. Similarly, all students enrolled in courses designated as requiring student use of University, School, or Departmental laboratory resources will be charged a laboratory course fee of \$15 per summer session. The maximum course fee to be charged to any student will be \$30 per summer session regardless of the computer and/or laboratory courses taken.

**COURSES REQUIRING COMPUTER OR LABORATORY COURSE
FEES
SUMMER SESSIONS, 1984**

ANS	204	CSE	452	IA	115
	403		453		122
	410	ECE	202L	MAE	305
ARC	400		301		306
BCH	554		302	MAT	200
			513		
BO	200	ED	598T	MEA	110
	360	ENT	425	PP	503
	421			PVD	400
BS	100	FLF	101		
			102	PY	205L
CE	326		201		208L
	382				211L
CH	101L	FLG	101		212L
	103L		102		231
	104	FLS	101	SOC	416
	107		101E		
	220L		102	ST	516
	221L		102E		
	223L			T	105
	315L	FOR	111		220L
			204		250L
CHE	205		261	TX	621
	225		264		
			274	WPS	205
CSC	101E		591B	ZO	201
	102E				212
	111	FW	310		303
	200A	HS	101		360
	200B				
	201E				
	252E				
	302				
	311E				
	312				

Course fees will be assessed for courses officially carried at 5:00 p.m. on Monday, May 28, 1984 for the First Session; Wednesday, July 11, 1984 for the Second Session; Thursday, June 7, 1984 for the Ten-Week Session; and, Thursday, July 12, 1984 for the Adult Education Session.

RESIDENCE STATUS CLASSIFICATION FOR TUITION PURPOSES

To qualify as a resident for tuition purposes, a person must have established legal residence (domicile) in North Carolina and maintained that legal residence for at least twelve months immediately prior to his or her classification as a resident for tuition purposes. To be eligible for classification as a resident for tuition pur-

poses a person must establish that his or her presence in the State is, and during the requisite twelve month qualifying period was, for purposes of maintaining a bona fide domicile rather than of maintaining a mere temporary residence or abode incident to enrollment in an institution of higher education.

North Carolina General Statute (G. S.) 116-143.1 is the governing law concerning resident status classification and sets forth statutory definitions, rules and special provisions for determining resident status for tuition purposes. Copies of the law and implementing regulations are found in *A Manual to Assist the Public Higher Education Institutions of North Carolina in the Matter of Student Residence Classification for Tuition Purposes* which is available for inspection in the Office of Undergraduate Admissions, 112 Peele Hall. Special situations concerning minors, the military, and marriage as they relate to residence status classification are addressed in *The Manual*. It is the student's responsibility to initiate a review of their situation when classification or re-classification as a resident for tuition purposes is sought.

Questions concerning residence status classification should be addressed to the Director of Undergraduate Admissions, North Carolina State University, Box 7103, 112 Peele Hall, Raleigh, North Carolina 27695-7103.

REFUND OF TUITION AND FEES

A student who withdraws from school on or before the fourth day of classes of either summer session will receive a refund of the full amount paid, less a \$15 registration fee. (Students enrolled in 10-week evening courses who withdraw before the fourth scheduled class meeting will also receive a full refund less the \$15 registration fee.) After the period specified, no refunds will be made.

In some instances, circumstances justify waiving rules regarding refunds. An example might be withdrawal from the University because of illness. Students have the privilege of appeal to the Fee Appeals Committee when they feel special consideration is merited. Application for such appeals may be secured from the Department of Registration and Records (100 Harris Hall) or University Cashier and Student Accounts Office (2 Peele Hall).

FINANCIAL AID

The financial aid available to regular students attending the Summer Sessions is ordinarily limited to loans and work-study jobs. Students who wish to be considered for financial aid should make application to the Financial Aid Office, Peele Hall, as far in advance as possible, preferably no later than March 30, 1984. Summer applications will be available in early March.

The University has no financial aid for summer visitor students. However, these students may have access to the part-time job listings on the bulletin board outside the Financial Aid Office, 2nd Floor, Peele Hall.

COUNSELING

The Counseling Center provides services designed to assist individuals in gaining a better understanding of themselves and their opportunities. Professional counselors are available to work with students who desire assistance with concerns such as: choosing a career; planning an academic program leading to a career; identifying and overcoming educational difficulties; developing greater self-understanding;



Ms. Anne C. Clapp, assistant professor in the Department of Textile Materials and Management demonstrates an air-jet loom to a class in textile management.

and developing more satisfying personal relationships. All counseling is strictly confidential.

In addition to individual counseling, workshops are offered throughout the year in a variety of areas, including vocational exploration, study skills, and anxiety-reduction.

Counseling services are available without cost to NCSU students. Appointments may be scheduled over the telephone (737-2423) or in person by coming to 200 Harris Hall.

HOUSING

RESIDENCE HALLS

During the 1984 summer sessions, housing will be provided in the residence halls on a first-come, first-served basis for men and women who are enrolled for one or more courses. [Participants in short courses, camps, workshops and other special summer conference groups will be located in separate facilities. These persons should contact the Housing Department (919/737-2410) for specific housing information pertaining to their group (see SUMMER CONFERENCE HOUSING).]

Assignment to a room for a summer session does not guarantee that a room will be available for the fall semester. A student must be accepted by NCSU for fall enrollment as a full-time student to be eligible to apply for University housing.

ROOM RENTALS AND APPLICATIONS

The rental rate for a five-week session is \$115.00 per person in a double room. If space is available, a single room may be reserved for \$190.00 each session. To obtain an assignment, the student must complete the housing request card and return it

with a check to the University Cashier & Student Accounts Office, NCSU, Box 7213, Raleigh, N.C. 27695-7213. The room assignment will be mailed if time permits, or may be picked up at the Student Housing Office in Harris Hall on the day the residence halls open for the session.

NOTE: Participants in short courses, workshops, or conferences do not qualify for these rates. These persons should write to Mr. Kenneth Boham, Assistant Director, Housing Department, Box 7315, Raleigh, N.C. 27695-7315, or telephone (919) 737-2410 for specific housing information.

Residents will be permitted to change rooms after the first week of classes with the approval of the Student Housing Office. The room change fee is \$5.00. *Opening days of the residence halls will be as follows:*

FIRST SESSION—10 a.m., MONDAY, MAY 21, 1984

SECOND SESSION—10 a.m., WEDNESDAY, JULY 4, 1984

HOUSING REFUND POLICY

Cancellation of a room reservation must be made in writing as follows:

- (a) In person at the Housing Office in Harris Hall, Monday through Friday, between 8 a.m. and 5 p.m., on the cancellation form provided; or
- (b) By mail addressed to the Student Housing Office, Box 7315, NCSU, Raleigh, N.C., 27695-7315.

The effective date of cancellation is the date notification is received at the Student Housing Office or the date the room is vacated, whichever is later. Residents who have moved into their rooms must present their Check-out Card to the Student Housing Office when applying for a room rent refund.

If the housing contract is cancelled on or before Registration Day, the rental fee paid will be refunded less a \$15 processing fee. If the housing contract is cancelled AFTER 5 p.m. on Registration Day, NO REFUND of room rent will be made except in cases of medical withdrawals. In these instances, a \$15 processing fee will be charged plus \$3.00 a day from date of occupancy.

If a student fails to check in and secure his/her keys by 5 p.m. on Registration Day, the housing contract will be cancelled and NO REFUND will be made except as stated above.

STUDENT FAMILY HOUSING

The University operates E.S. King Village as an apartment complex for students with families. This complex consists of 300 apartments (120 efficiency, 148 1-bedroom and 32 2-bedroom). Interested students should write to the Department of Special Projects/King Village Office, P Building, NCSU, Raleigh, N.C., 27607, for family housing applications and information.

FRATERNITY HOUSES

Several of the 20 fraternity houses located on or adjacent to the campus provide housing for summer sessions students. Twelve of the 20 houses are fully air conditioned and all provide furnished rooms and living areas. In addition, some houses offer board plans during the summer months. Any student interested in further details should write to the Office of Student Development, Box 7314, NCSU, Raleigh, N.C., 27695-7314 or telephone (919) 737-2441.

SUMMER CONFERENCE HOUSING

Participants in short courses, camps, workshops, and other special summer conference groups can reserve rooms in residence halls separate from summer school students. Room rental rates vary on a per day basis depending on the type of services provided—single or double room, air conditioning, linen service. Interested persons should contact the Housing Department, NCSU, Box 7315, Raleigh, N.C., 27695-7315 or telephone Wolfpack Teletip, (919) 737-3737 and ask for tape #S-668. Requests for space should be submitted as soon as possible.

D. H. HILL LIBRARY

The libraries of North Carolina State University contain more than 1,000,000 volumes of books and bound journals, 600,000 federal government publications, and 2 million microforms. The collection is especially strong in the physical and biological sciences, agriculture, textiles, architecture and design. The D. H. Hill Library houses the vast majority of these publications and subscribes to over 8,000 periodicals. Five branch libraries—the School of Textiles Library in Nelson Hall, the Design School Library in Brooks Hall, the School of Forest Resources Library in Biltmore Hall, Veterinary Medical Library in the School of Veterinary Medicine, and the Curriculum Materials Center in Poe Hall—serve the special needs of their schools.

The D. H. Hill Library has been a depository for U. S. Government publications since 1924 and receives over 97% of these publications. The library also receives the microfiche research reports published by the Department of Energy (DOE), the



Summer is a great time to sharpen up your golf form. Ms. Virginia Leath (right), an NCSU physical education lecturer, gives tips on the putting green

National Aeronautical and Space Administration (NASA), the Educational Resources Information Center (ERIC), and the National Technical Information Service (NTIS).

On-line computer-based literature searching is offered by the library from a number of data bases such as ERIC, AGRICOLA (Bibliography of Agriculture), Psychological Abstracts, Sociological Abstracts, BIOSIS (Biological Abstracts), and Nuclear Science Abstracts. Only direct costs are charged to the user.

Facilities and equipment are also available for both individual and group use of audiovisual media. The library's theater can be scheduled for group media presentations, and films in the State Library's film collection can be borrowed by the D. H. Hill Library's Media Center for academic use by faculty and students.

The scholar, student, and browser will each discover the materials and services of the library to be useful and enjoyable additions to his or her summer sessions program. All areas of the library complex are air-conditioned and open to students and faculty.

Library hours for the Summer Sessions are as follows:

Monday-Thursday	7:45 a.m.-12:00 midnight
Friday	7:45 a.m.- 9:30 p.m.
Saturday	9:00 a.m.- 5:30 p.m.
Sunday	1:00 p.m.-12:00 midnight

SUMMER ACTIVITIES

Through many curricular and extracurricular activities, the Summer Sessions provide special opportunities to those students engaged in summer study. Interesting, informative and entertaining programs and activities are scheduled for each session.

A few of the more popular activities and special features include the Carmichael Gym athletic and recreation programs and the varied activities sponsored by the University Student Center.

The University's regular program of student personnel services is available to summer students. It includes the Counseling Center for educational, career and personal counseling; the Career Planning and Placement Center for career planning and placement; the Residence Life and Residence Facilities offices for residence quarters; the Financial Aid Office for financial assistance; and the Student Health Service for medical care.

Beyond the campus, the city of Raleigh offers cultural and recreational opportunities of interest to students. The Raleigh Little Theater presents several productions during the summer, the North Carolina Museum of Art sponsors gallery concerts and exhibits, and there are several swimming pools and city and state parks located in and around Raleigh.

UNIVERSITY STUDENT CENTER

The hub of campus summer activity is the University Student Center. The Center is supported in part by student fees, and all Summer Sessions students are invited to attend the programs and activities sponsored by the Summer Programs Board. These programs include movies and a variety of social and recreational events.

The air-conditioned Center offers many facilities, including a television lounge, an art gallery, offices for student organizations, a game room, snack bar, theater

and meeting rooms. The Crafts Center in the Thompson Building has a full range of crafts programs.

University Student Center hours during the summer are:

Monday-Friday

7:30 a.m.-11:00 p.m.

Saturday-Sunday

9:00 a.m.-11:00 p.m.

SPECIAL COURSES AND INSTITUTES

Department of Adult and Community College Education

REGIONAL SUMMER SCHOOL FOR ADULT AND EXTENSION EDUCATORS

July 9-27, 1984

The Department of Adult & Community College Education offers a special three-week summer program of instruction designed to provide graduate study and professional improvement opportunities for educators. This intensive session assists extension workers, community college instructors and administrators, and others to increase their understanding of topics such as community practice of adult education, current issues in community colleges, use of microcomputers, accountability and evaluation, and effective communication for managers. It also offers opportunities for keeping up-to-date in areas of agricultural technology.

The program is interdisciplinary; it enlists the professional competence of visiting and resident faculty. Courses meet daily in blocks scheduled for morning and afternoon. Some are offered in modules, making it possible to enroll for less than three weeks. Each participant may take a maximum of five semester hours. Course offerings are listed below.

Currently enrolled degree students at North Carolina State University must preregister through the normal preregistration procedures. All lifelong education students must preregister by completing the Summer Sessions Registration Application in the front of this bulletin. Lifelong education students should see page 00 for additional information. Students enrolling for the special three-week session will be allowed to complete registration during the first class session. To assist the Department of Adult and Community College Education in planning, students are requested to complete and return an application form by May 11, 1984. The form may be obtained from Dr. J. Wright, Department of Adult & Community College Education, NCSU, Box 7607, Raleigh, N.C. 27695-7607.

ANS 403	Swine Management
BAE 590A	Total Water Management Systems for Agricultural Production
BAE 590B	Microcomputers in Extension
EB 401	Economic Analysis for Non-Majors
EB 403	Economics of Consumer Decisions
EB 521	Markets and Trade
ED 596A	The Community Practice of Adult Education
ED 596B	Current Issues in Community Colleges—Effects of Economic Conditions
ED 596C	Current Issues in Community Colleges—Changing Patterns of Governance
ED 596D	Current Issues in Community Colleges—Assessment of Outcomes
ED 596F	Evaluation & Accountability—Measurement

ED	596G	Evaluation & Accountability—Data Collection/Reduction
ED	596H	Evaluation & Accountability—Analysis & Interpretation
ED	596I	Effective Communication Skills Training for Managers I
ED	596J	Effective Communication Skills Training for Managers II
FOR	591B	Private Woodlot Management
HS	562	Postharvest Physiology
SOC	498B	Changing Families in the '80's
SOC	591B	Social and Demographic Change

NCSU MIDDLE SCHOOL WORKSHOP—"ALTERNATIVES FOR THE MIDDLE YEARS"

(Listed as ED 598-F)

June 18-June 29

This Fifth Annual activity-oriented workshop is designed to help teachers and administrators develop humane and imaginative programs for students ages 10-15. It will focus upon (a) The developmental needs, interests and abilities of emerging adolescents; (b) Curriculum ideas and teaching methods; and (c) School organization strategies.

Participants will be involved in whole group activities and mini-courses which explore topics such as:

- Adolescence and contemporary society
- Learning styles
- Interdisciplinary inquiry
- Arts and the adolescent
- Learning environment/classroom design
- Creativity and the right side of the brain
- Competition and cooperation
- Case studies of outstanding schools
- Strategies for change
- Outdoor education
- Early adolescent sexuality
- Moral development & values clarification
- Adolescence and authority
- Cognitive and social development in adolescence
- All school activities
- Learning games and simulations
- The principal as educational leader

In addition, special electives will be offered in math, science, language arts and social studies.

Emphasis in most sessions will be placed upon activity, involvement and sharing. Films, slides, simulations, small group discussions, working with classroom materials, and a variety of other learning techniques will be utilized.

The workshop will be directed by John Arnold, Coordinator of Middle Years Education at NCSU, and Chris Stevenson, University of Vermont. Consultants from the State Department of Public Instruction and from area schools will serve on a part-time basis.

Sessions will be held Monday through Friday from 9:30 a.m. to 4:00 p.m. in the "Merry Monk" room of the old John Yancey Hotel (now North Hall). Three graduate credits will be granted to those who participate satisfactorily and complete a curriculum project.

Dormitory rooms ranging from \$5-12 per night per person, double occupancy, will be available for out of town participants. Rooms may be reserved by contacting the Department of Residence Facilities, 204 Harris Hall, NCSU Campus.

For further general information, write or call Dr. John Arnold, Department of Curriculum and Instruction, 402 Poe Hall, NCSU, Box 7801, Raleigh, N.C. 27695-7801.

SUMMER INSTITUTE ON SECOND LANGUAGE ACQUISITION

July 9-August 17, 1984

The Summer Institute on Second Language Acquisition is designed to serve the professional needs of Second Language teachers in the schools of North Carolina. It will focus upon a) in-service instruction in teaching methods, materials, and techniques; b) the nature of language and culture, and the language acquisition process; c) active involvement in either an ESL teaching practicum or an intensive workshop designed to develop and enhance foreign language skills.

Course activities will explore such topics as:

- ESL/FL teaching methods and techniques

- Tests and measurements

- Bilingual/Bicultural education

- Cross-cultural and multicultural comparisons and contrasts

- Linguistic structures

- Theories of first and second language acquisition

In addition, participants may choose to elect an ESL teaching practicum, or an intensive French or Spanish language experience.

Each of the courses will include lectures, class reports or class projects, and a final exam. Participants may register for one, two, or all three of the courses listed. Preference will be given to PBS, post-baccalaureate students, but NCSU undergraduate students will be allowed to participate, space permitting. Students may enroll for a total of 8 semester hours.

The Summer Institute will be directed by Dr. Arlene Malinowski, Program Coordinator for Foreign Language Teacher Education at North Carolina State University, and Tim Hart, Bilingual and Foreign Language Coordinator for Wake County Public Schools. The Institute is sponsored by the Departments of Foreign Languages and Curriculum and Instruction at North Carolina State University, the Wake County Public School System, and the North Carolina State Department of Public Instruction.

Classes will be held Monday through Friday from 9:00 a.m. to 12:00 noon and from 1:30 to 5:00 p.m. in Poe Hall. Arrangements for the ESL teaching practicum will be made at Wiley Elementary School, and the intensive French and Spanish classes will take place at Athens Senior High School in Raleigh.

Dormitory rooms ranging from \$5-\$12 per night per person, double occupancy, will be available for out of town participants. Rooms may be reserved by contacting the Department of Residence Facilities, 204 Harris Hall, NCSU Campus.

For further information, write or call Dr. Arlene Malinowski, Department of Foreign Languages and Literatures, NCSU, Box 8106, Raleigh, N.C. 27695-8106 (737-2475); or Tim Hart, Wake County Public Schools, Devereaux Street, Raleigh, N.C. (755-6080); or Dr. Barbara Parramore, Department of Curriculum and Instruction, NCSU, Box 7801, Raleigh, N.C. 27695-7801 (737-3221).

EVENING SUMMER SESSIONS AND UNDERGRADUATE DEGREE PROGRAMS

A ten-week session of evening classes, meeting twice a week May 23-August 8, and two five-week evening sessions, meeting four times a week May 23-June 28 and July 6-August 10, are offered for the convenience of evening degree students and Lifelong Education students. Many of the courses offered in the 1984 summer evening session may be used toward fulfilling the basic requirements for a B.A. degree from the School of Humanities and Social Sciences.

The following departments are offering evening classes during the 1984 Summer Sessions: Accounting, Anthropology, Computer Science, Computer Studies, Counselor Education, Curriculum and Instruction, Economics and Business, English, Mathematics, Physical Education, Psychology, Public Administration, Recreation Resources Administration, Sociology, Spanish, and Zoology. Please refer to the Course Listings beginning on page 34 for specific details.

Evening classes are offered in the First, Ten-Week, and Second Sessions.

For information concerning the evening degree and certificate programs in the School of Humanities and Social Sciences, contact Ms. Lynda Hambourger, Coordinator of Evening Programs, Room 106, Link Building, or call (919) 737-2467. Ms. Hambourger's office is open until 8:30 p.m., Monday through Thursday and until 5 p.m. on Friday.

SUMMER INSTITUTE IN ENGLISH FOR SPEAKERS OF OTHER LANGUAGES

July 2-August 11

The Summer Institute in English for Speakers of Other Languages at North Carolina State University is designed for those students from other countries who intend to pursue university studies or specialized training programs in the United States in the fall. It is designed to furnish them with intensive instruction and practice in the use of the English language. Emphasis is placed on developing fluency in speaking and understanding oral English as well as reading and writing skills. The Institute also offers orientation to American life and institutions to give the students insight into life in the U. S. and help them to adjust to the new environment. There are field trips on weekends to places of historic, cultural and scenic interest.

Any student who has a score of 400 on the TOEFL (Test of English as a Foreign Language) or an equivalent facility in the use of spoken English may attend the Institute. (Information about taking the test at one of the centers located in the students' home countries may be obtained by writing to: Test of English as a Foreign Language, Educational Testing Service, Princeton, New Jersey.)

Admission to the Institute does not imply admission as a degree candidate at North Carolina State University or any other campus of The University of North Carolina.

The Institute, which is sponsored by the Division for Lifelong Education in cooperation with the Summer Sessions and the Department of Foreign Languages and Literatures, is under the direction of Miss Virginia Prichard of the Department of Foreign Languages and Literatures. All classroom work is conducted on the campus. Classes, including language laboratory practice sessions, are held five and a half hours a day, Monday through Friday, from 8:00 to 12:30 and 2:00 to 3:00. (Attendance at the Institute does not carry academic credit, although students who complete the program receive a certificate of attendance.)

The total cost of the six-week program is approximately \$1,400. The cost of the Institute is estimated on the basis of campus dormitory accommodations and meals at the campus cafeterias. Incidental expenses, such as laundry, dry cleaning, entertainment, etc., are not included. (Room rent includes sheets and towels.)

Course and Books/Materials Fees	\$540.00
Room in Campus Dormitory (Estimated)	\$350.00
Food (Estimated)	\$420.00

For further information about the Institute, write to Denis S. Jackson, Program Coordinator, Division for Lifelong Education, Box 7401, NCSU, Raleigh, North Carolina 27695-7401.

A SUMMER AT OXFORD

In cooperation with the University of North Carolina at Asheville, the Division of Student Affairs and the School of Humanities and Social Sciences at North

Tennis is a sport widely enjoyed by students during summer sessions. There are a number of courts on campus for student use.



Carolina State University will again sponsor a summer school for approximately 30 students at St. Benet's Hall, Oxford, England. St. Benet's, a permanent private hall of Oxford University, is a most attractive 18th century building in the center of this ancient university city.

Courses, taught by faculty associated with Oxford, will be offered in Shakespeare, Britain and World War II, Europe and the European Community, and Art Treasures of Oxford. Where appropriate, these courses will involve visiting speakers and field trips. Thus the Shakespeare course will be built around next summer's repertoire of the Royal Shakespeare Company at Stratford-on-Avon.

Fees for the four-week program including room, board and tuition, will be about \$975. Air fare is additional. The summer school will be held from July 6 to August 4, 1984, and afterwards students will be free to travel in the British Isles and the Continent. For further information, contact Dean Gerald Hawkins, Student Affairs, phone (919) 737-3151.

LANGUAGE AND CULTURE STUDY PROGRAM IN MEXICO

The Department of Foreign Languages and Literatures is sponsoring its *Third Summer Language and Culture Study Program in MEXICO from May 23 through June 19, 1984 (corresponding to the first summer session)*. The program features a period of intensive study at the Centro Internacional de Lenguas y Culturas de America Latina (CILCAL) in Cuernavaca, from which students can gain up to 6 academic credits.

The program is designed to foster an oral command of the language either as a new skill or as reinforcement of previous studies, and to provide an enrichment of cultural knowledge of the Mexican civilization. Students will spend five days in Mexico City with visits and excursions to places of cultural and historical interest, after which they will attend classes in Cuernavaca for four hours a day. While in Cuernavaca, students will be provided with an opportunity to immerse themselves in the Mexican culture by living with a Mexican family. The final four days will be spent in Acapulco.

Beginning students who complete the program successfully may receive credits for the equivalent course(s) at North Carolina State University (FLS 101 through 202) for a total of six credits, an ideal way of satisfying the language requirement. In addition, advanced students or Spanish majors may receive up to six credits, consisting of a Special Topics course (FL 495) "Studies in Mexican Culture" and/or a Conversation course either at the advanced level (308) or at the intermediate (203) level.

For further information, contact Dr. Dario Cortez, Department of Foreign Languages and Literatures, Box 8106, NCSU, Raleigh, N.C. 27695-8106. Telephone (919) 737-2475.

INDEPENDENT STUDY BY EXTENSION

In addition to the classes listed in this schedule, many undergraduate courses are available through independent study (correspondence instruction). This program allows students to enroll at any time, to work at their own pace, and to take up to thirteen months to complete a course. For further information about independent study, including a complete listing of courses, contact Independent Study by Extension, 201 Abernethy Hall 002A, University of North Carolina, Chapel Hill, North Carolina 27514, Telephone (919) 962-1106.



COURSE LISTINGS

Courses are listed by department, departmental abbreviation and numerical designator. Semester hour credits for each course are given following the name of the course. Classes meet daily, Monday through Friday, except where specified to the contrary. The symbols "LR," "LB" and "PR" before the clock hours refer to "lecture-recitation," "laboratory" and "problem-solving session," respectively. If there is no symbol before the clock hours, lecture-recitation is implied.

The number in parentheses to the right of the class meeting time is the "Cal Number". This number must be indicated on the preregistration schedule request form by students who are preregistering for summer sessions courses.

Courses numbered from one through 99 are preparatory courses carrying no college credit; courses in the 100, 200, 300 and 400 series are primarily designed for undergraduates; courses in the 500 series for graduates and advanced undergraduates; and courses in the 600 series for graduates only. Consent of the department is required to register for all practicum and individual special topics or special problems courses as well as internships and thesis or dissertation research.

All courses are subject to cancellation by the Director of Summer Sessions if there is inadequate enrollment.

Waiver of prerequisites is at the discretion of the instructor.

Please note that class meeting times in this bulletin are indicated in international time which is measured in hours numbered to 24 instead of 12.



If the schedule shows the class beginning at:	The beginning hour in terms of a 12-hour clock is:
0800	8:00 a.m.
0900	9:00 a.m.
1000	10:00 a.m.
1100	11:00 a.m.
1200	12:00 noon
1300	1:00 p.m.
1400	2:00 p.m.
1500	3:00 p.m.

If the schedule shows the class beginning at:	The beginning hour in terms of a 12-hour clock is:
1600	4:00 p.m.
1700	5:00 p.m.
1800	6:00 p.m.
1900	7:00 p.m.
2000	8:00 p.m.
2100	9:00 p.m.
2200	10:00 p.m.

SPECIAL GRADUATE CATEGORIES

FIRST SESSION AND SECOND SESSION

GR 596S	MR Summer Research	(46-596-001) 0
GR 597	Master's Exam Only	(46-597-001) 0
GR 598	MR Thesis Preparation	(46-598-001) 0
GR 696S	DR Summer Research	(46-696-001) 0
GR 697	Dissertation Research	(46-697-001) 0
GR 698	DR Thesis Preparation	(46-698-001) 0

Accounting

FIRST SESSION

ACC 260 Accounting I—Concepts of Financial Reporting	3
0800-0930 (04-260-001)	Zuckerman
0950-1120 (04-260-002)	Peace
1140-1310 (04-260-003)	Staff
1340-1510 (04-260-004)	Staff

ACC 261 Accounting II—An Introduction to Managerial Accounting	3
Prerequisite: ACC 260	
0950-1120 (04-261-001)	Zuckerman

ACC 262 Managerial Uses of Cost Data	3
Prerequisite: ACC 261	
0800-0930 (04-262-001)	Skender

ACC 360 Intermediate Financial Accounting I	3
Prerequisite: ACC 261	
0950-1120 (04-360-001)	Griffin

ACC 364 An Introduction To Income Taxation	3
Prerequisites: ACC 260 and EB 201	
0800-0930 (04-364-001)	Peace

ACC 466 Auditing Financial Information	3
Prerequisites: ACC 361, EB (ST) 350	
0950-1120 (04-466-001)	Skender

SECOND SESSION

ACC 260 Accounting I—Concepts of Financial Reporting	3
0800-0930 (04-260-001)	Rockness
1140-1310 (04-260-002)	Staff
0950-1120 (04-260-003)	Staff

ACC 261 Accounting II—An Introduction to Managerial Accounting	3
Prerequisite: ACC 260	
0950-1120 (04-261-001)	Windham

ACC 361 Intermediate Financial Accounting II	3
Prerequisite: ACC 360	
0950-1120 (04-361-001)	Rockness

ACC 460 Specialized Financial Reporting Theory and Practice	3
Prerequisite: ACC 361	
0800-0930 (04-460-001)	Windham

TEN WEEK SESSION

ACC 260E Accounting I—Concepts of Financial Reporting

1745-1930 TuTh (04-260-005)

1945-2030 TuTh (04-260-006)

3

Jefferys

Jefferys

Animal Science

FIRST SESSION

ANS 590 Topical Problems in Animal Science

Hours arranged (10-590-001)

Maximum 6

Staff

ANS 699 Research in Animal Science

Hours arranged (10-699-001)

Credits Arranged

Staff

SECOND SESSION

ANS 204 Livestock Feeds and Feeding

LR 0800-0900 (10-204-001)

LB 1340-1620 TuTh (10-204-101)

3

Pond

ANS 410 Horse Science

LR 1020-1120 (10-410-001)

LB 1340-1620 MW (10-410-101)

3

Cornwell

ANS 590 Topical Problems in Animal Science

Hours arranged (10-590-001)

Maximum 6

Staff

ANS 699 Research in Animal Science

Hours arranged (10-699-001)

Credits Arranged

Staff

ADULT EDUCATION SESSION

ANS 403 Swine Management

Prerequisite: ANS 204

0900-1200 (10-403-001)

3

Esbenshade

Anthropology

FIRST SESSION

ANT 251 Physical Anthropology

1140-1310 (12-251-001)

3

Rovner

ANT 252 Cultural Anthropology

0800-0930 (12-252-001)

0950-1120 (12-252-002)

3

Wallace

Ellovich

ANT 252E Cultural Anthropology

1745-1930 MTuWTh (12-252-003)

3

Ellovich

ANT 253 Prehistoric Archaeology

0950-1120 (12-253-001)

3

Rovner

ANT 254 Language and Culture

0950-1120 (12-254-001)

3

Wallace

ANT 498 Special Topics in Anthropology

Prerequisite: Six hours of SOC/ANT

Hours arranged (12-498-001)

1-6

Sawhney

SECOND SESSION

ANT 251 Physical Anthropology	3
0950-1120 (12-251-001)	Staff
ANT 252 Cultural Anthropology	3
0800-0930 (12-252-001)	Nickerson
0950-1120 (12-252-002)	Nickerson
ANT 498 Special Topics in Anthropology	1-6
Prerequisite: Six hours of SOC/ANT	
Hours arranged (12-498-001)	Sawhney
ANT 591 Special Topics in Anthropology	1-6
Prerequisite: ANT 501 or equivalent	
Hours arranged (12-591-001)	Moxley

Architecture

FIRST SESSION

ARC 400 Intermediate Architectural Design	6
Prerequisite: DF 102	
1300-1700 MTuWTh (13-400-001)	Rand
May 23-July 18—Eight Week Course—Final Exam July 20	
*ARC 595 Independent Study	1-3
Prerequisite: Graduate standing	
Hours arranged	Burns
ARC 691 Special Topics in Architecture	1-6
Prerequisite: Graduate standing	
Hours arranged (13-691-001)	Burns

* Students may not preregister for this course. Course may be added on Registration Day, May 22.

SECOND SESSION

*ARC 595 Independent Study	1-3
Prerequisite: Graduate standing	
Hours arranged	Burns
ARC 692 Special Topics in Architecture	1-6
Prerequisite: Graduate standing	
Hours arranged (13-692-001)	Burns

*Students may not preregister for this course. Course may be added on Registration Day, July 5.

Biological and Agricultural Engineering

FIRST SESSION

BAE 590 Special Problems	Credits Arranged
Prerequisite: Senior or Graduate standing in Biological and Agricultural Engineering	
Hours arranged (16-590-001)	Staff
BAE 690 Special Topics	1-4
Prerequisite: Graduate standing	
Hours arranged (16-690-001)	Staff

BAE 699 Research in Biological and Agricultural Engineering	Credits Arranged
Prerequisite: Graduate standing in Biological and Agricultural Engineering	
Hours arranged (16-699-001)	Staff
SECOND SESSION	
BAE 590 Special Problems	Credits Arranged
Prerequisite: Senior or Graduate standing in Biological and Agricultural Engineering	
Hours arranged (16-590-001)	Staff
BAE 690 Special Topics	1-4
Prerequisite: Graduate standing	
Hours arranged (16-690-001)	Staff
BAE 699 Research in Biological and Agricultural Engineering	Credits Arranged
Prerequisite: Graduate standing in Biological and Agricultural Engineering	
Hours arranged (16-699-001)	Staff

ADULT EDUCATION SESSION

BAE 590A Special Problems: Total Water Management Systems for Agricultural Production	3
Prerequisite: Senior or Graduate standing in Biological and Agricultural Engineering	
0900-1600 (16-590-002)	Sneed/Evans
BAE 590B Special Problems: Microcomputers in Extension	1
Prerequisite: Senior or Graduate standing in Biological and Agricultural Engineering	
0900-1600 (16-590-003)	Sowell
July 9-July 13	
0900-1600 (16-590-004)	Sowell
July 16-July 20	
0900-1600 (16-590-005)	Sowell
July 23-July 27	

Biochemistry

FIRST SESSION

BCH 490 Special Studies in Biochemistry	1-3
Prerequisite: Senior standing	
Hours arranged (15-490-001)	Staff
BCH 554 Radioisotope Techniques in Biology	2
Prerequisite: BCH 451 or Consent of Instructor	
0810-1200 (15-554-001)	Sisler
May 23-June 13—Three-week course—Final Exam June 13	
BCH 590 Special Topics in Biochemistry	Credits Arranged
Prerequisite: BCH 451 or equivalent	
Hours arranged (15-590-001)	Staff
BCH 695 Special Topics in Biochemistry	Credits Arranged
Prerequisite: Graduate standing in BCH	
Hours arranged (15-695-001)	Staff
BCH 699 Biochemical Research	Credits Arranged
Hours arranged (15-699-001)	Staff

SECOND SESSION

BCH 451 Introductory Biochemistry	3
Prerequisite: CH 223	
0950-1120 (15-451-001)	Main
BCH 490 Special Studies in Biochemistry	1-3
Prerequisite: Senior standing	
Hours arranged (15-490-001)	Staff
BCH 590 Special Topics in Biochemistry	Credits Arranged
Prerequisite: BCH 451 or equivalent	
Hours arranged (15-590-001)	Staff
BCH 695 Special Topics in Biochemistry	Credits Arranged
Prerequisite: Graduate standing in BCH	
Hours arranged (15-695-001)	Staff
BCH 699 Biochemical Research	Credits Arranged
Hours arranged (15-699-001)	Staff

Biomathematics

FIRST SESSION

BMA 591 Special Topics	Maximum 3
Prerequisite: Consent of Instructor	
Hours arranged (18-591-001)	Staff
BMA 691 Advanced Special Topics	1-3
Prerequisite: Consent of Instructor	
Hours arranged (18-691-001)	Staff
BMA 699 Research	Credits Arranged
Hours arranged (18-699-001)	Staff

SECOND SESSION

BMA 591 Special Topics	Maximum 3
Prerequisite: Consent of Instructor	
Hours arranged (18-591-001)	Staff
BMA 691 Advanced Special Topics	1-3
Prerequisite: Consent of Instructor	
Hours arranged (18-691-001)	Staff
BMA 699 Research	Credits Arranged
Hours arranged (18-699-001)	Staff

Botany

FIRST SESSION

BO (ZO) 360 Introduction to Ecology	4
(See Zoology)	
BO 421 Plant Physiology	4
Prerequisites: BS 100 or BS 105 or BO 200 and one year of college chemistry	
LR 0800-0930 (19-421-001)	Weintraub
LB 1340-1750 MW (19-421-101)	
LB 1340-1750 TuTh (19-421-102)	

SECOND SESSION

BO 200 Plant Life

LR 0800-0930 (19-200-001)

LB 1340-1750 MW (19-200-101)

LB 1340-1750 TuTh (19-200-102)

4
Beckmann

Biological Sciences

FIRST SESSION

BS 100 General Biology

Students may not receive credit for both BS 100 and BS 105

LR 0800-0930 (17-100-001)

LB 1020-1300 TuTh (17-100-101)

LB 1340-1620 TuTh (17-100-102)

LB 1020-1300 WF (17-100-103)

LB 1340-1620 WF (17-100-104)

4
Wynn

BS 495A Special Topics in Biology

Hours arranged (17-495-001)

1-6
Lytle

SECOND SESSION

BS 495A Special Topics in Biology

Hours arranged (17-495-001)

1-6
Lytle

BS 495B Special Topics in Biology—Advanced Biology for Secondary Teachers

LR 0800-0930 (17-495-002)

LB 1020-1230 and 1340-1550 MTuWTh (17-495-101)

June 18-July 20—Five Week Course

6
Lytle/Coffey

Civil Engineering

FIRST SESSION

CE 213 Introduction to Mechanics

Corequisite: MA 202

0800-0930 (22-213-001)

3
Staff

CE 214 Engineering Mechanics—Statics

Prerequisite: PY 205

Corequisite: MA 202

0800-0930 (22-214-001)

3
Staff

CE 215 Engineering Mechanics—Dynamics

Prerequisite: A grade of C or better in CE 214

Corequisite: MA 301

0800-0900 (22-215-001)

2
Staff

CE 313 Mechanics of Solids

Prerequisite: A grade of C or better in CE 214

Corequisite: MA 301

1000-1130 (22-313-001)

3
Staff

CE 507 Airphoto Analysis I

Prerequisite: Senior standing

0800-1000 (22-507-001)

3
Staff

CE 598 Civil Engineering Projects	1-3
Hours arranged (22-598-001)	Staff
CE 698 Advanced Reading in Civil Engineering	1-3
Prerequisite: Graduate standing	
Hours arranged (22-698-001)	Staff
CE 699 Civil Engineering Research	Credits Arranged
Hours arranged (22-699-001)	Staff

SECOND SESSION

CE 214 Engineering Mechanics—Statics	3
Prerequisite: PY 205	
Corequisite: MA 202	
1000-1130 (22-214-001)	Staff
CE 215 Engineering Mechanics—Dynamics	2
Prerequisite: A grade of C or better in CE 214	
Corequisite: MA 301	
0800-0900 (22-215-001)	Staff
CE 313 Mechanics of Solids	3
Prerequisite: A grade of C or better in CE 214	
Corequisite: MA 301	
1000-1130 (22-313-001)	Staff
CE 598 Civil Engineering Projects	1-3
Hours arranged (22-598-001)	Staff
CE 698 Advanced Reading in Civil Engineering	1-3
Prerequisite: Graduate standing	
Hours arranged (22-698-001)	Staff
CE 699 Civil Engineering Research	Credits Arranged
Hours arranged (22-699-001)	Staff

TEN-WEEK SESSION

CE 325 Structural Analysis	4
Prerequisites: CE 202 and CE 313	
LR 1000-1115 MWF (22-325-001)	
LB 1000-1130 TuTh (22-325-101)	Staff
CE 326 Structural Engineering I	5
Prerequisite: CE 325	
1000-1130 (22-326-001)	Staff
CE 382 Hydraulics	4
Prerequisites: CE 202, CE 215, MA 301	
LR 0800-0915 MWF (22-382-001)	
LB 0800-1000 TuTh (22-382-101)	Staff

Chemistry

FIRST SESSION

CH 101 General Chemistry I	4
Prerequisite: MA 111	
LR 0800-0930 (21-101-001)	
LB 0940-1340 MW (21-101-101) (21-101-102) (21-101-103)	Staff
LB 1340-1750 MW (21-101-110) (21-101-111) (21-101-112)	

CH 104 Experimental Chemistry	1
Prerequisite: CH 101	
Corequisite: CH 105	
1340-1750 MW (21-104-001)	Staff
CH 105 Chemistry—Principles and Applications	3
Prerequisite: A grade of C or better in CH 101. Credit cannot be received for both CH 105 and either CH 103 or CH 107.	
0950-1120 (21-105-001)	Staff
CH 107 Principles of Chemistry	4
Prerequisite: CH 101 with a grade of C or better	
LR 0950-1120 (21-107-001)	Staff
LB 1340-1750 MW (21-107-109) (21-107-113) (21-107-114) (21-107-115)	
CH 111 Foundations of Chemistry	4
1340-1620 (21-111-001)	Staff
CH 220 Introductory Organic Chemistry	4
Prerequisites: CH 103 or CH 107, CH 104 and CH 105	
LR 0800-0930 (21-220-001)	Staff
LB 0940-1340 TuTh (21-220-107)	
LB 1340-1750 TuTh (21-220-110)	
CH 221 Organic Chemistry I	4
Prerequisite: CH 107	
LR 0800-0930 (21-221-001)	Staff
LB 0940-1340 MW (21-221-101) (21-221-102) (21-221-103)	
LB 1340-1750 MW (21-221-105) (21-221-106)	
CH 223 Organic Chemistry II	4
Prerequisite: CH 221	
LR 0800-0930 (21-223-001)	Staff
LB 0940-1340 TuTh (21-223-109)	
LB 1340-1750 TuTh (21-223-111) (21-223-112)	
CH 315 Quantitative Analysis	4
Prerequisites: CH 103 or CH 107, or CH 104 and CH 105	
LR 0800-0930 (21-315-001)	Staff
LB 0940-1340 MW (21-315-101)	
LB 1340-1750 MW (21-315-102)	
CH 431 Physical Chemistry I	3
Prerequisites: CH 107, MA 202, PY 203 or PY 208	
Corequisite: MA 301	
0950-1120 (21-431-001)	Staff
CH 499 Senior Research in Chemistry	1-3
Prerequisite: Three years of Chemistry	
Hours arranged (21-499-001)	Hanck
CH 699 Chemical Research	Credits Arranged
Prerequisite: Graduate standing in Chemistry	
Hours arranged (21-699-001)	Hanck
SECOND SESSION	
CH 101 General Chemistry I	4
Prerequisite: MA 111	
LR 0800-0930 (21-101-001)	Staff
LB 0940-1340 MW (21-101-001) (21-101-102)	
LB 1340-1750 MW (21-101-110) (21-101-111)	

CH 103 General Chemistry II	4
Prerequisite: CH 101	
LR 0800-0930 (21-103-001)	Staff
LB 0940-1340 MW (21-103-104)	
LB 1340-1750 MW (21-103-112)	
CH 104 Experimental Chemistry	1
Prerequisite: CH 101	
Corequisite: CH 105	
1340-1750 MW (21-104-001)	Staff
CH 105 Chemistry Principles and Applications	3
Prerequisite: A grade of C or better in CH 101. Credit cannot be received for both CH 105 and either CH 103 or CH 107.	
0950-1120 (21-105-001)	Staff
CH 107 Principles of Chemistry	4
Prerequisite: CH 101 with a grade of C or better	
LR 0800-0930 (21-107-001)	Staff
LB 1340-1750 MW (21-107-109) (21-107-113) (21-107-114) (21-107-115)	
CH 223 Organic Chemistry II	4
Prerequisite: CH 221	
LR 0800-0930 (21-223-001)	Staff
LB 0940-1340 TuTh (21-223-109)	
LB 1340-1750 TuTh (21-223-111) (21-223-112)	
CH 433 Physical Chemistry II	3
Prerequisites: CH 431 and MA 301	
0950-1120 (21-433-001)	Staff
CH 499 Senior Research in Chemistry	1-3
Prerequisite: Three years of Chemistry	
Hours arranged (21-499-001)	Hanck
CH 699 Chemical Research	Credits Arranged
Prerequisite: Graduate standing in Chemistry	
Hours arranged (21-699-001)	Hanck

Chemical Engineering

FIRST SESSION

CHE 205 Chemical Process Principles	4
Prerequisites: MA 201, PY 205, CH 107	
Corequisite: MA 202	
0900-1045 (20-205-001)	Setzer
CHE 497 Chemical Engineering Projects	1-3
Prerequisite: Senior standing	
Hours arranged (20-497-001)	Hopfenberg
CHE 699 Research	Credits Arranged
Hours arranged (20-699-001)	Hopfenberg

SECOND SESSION

CHE 225 Chemical Process Systems	3
Prerequisites: PY 208, C or better in CHE 205	
Corequisite: MA 301	
0900-1045 (20-225-001)	Marsland

CHE 497 Chemical Engineering Projects

1-3

Prerequisite: Senior standing

Hours arranged (20-497-001)

Hopfenberg

CHE 699 Research

Hours arranged (20-699-001)

Credits Arranged

Hopfenberg

CO-OP PROGRAM**FIRST SESSION AND SECOND SESSION****Engineering Students Only****COP 100E Co-op Work Program**

0

Hours arranged (25-100-001)

Unwin

COP 200E Co-op Work Program

0

Hours arranged (25-200-001)

Unwin

COP 300E Co-op Work Program

0

Hours arranged (25-300-001)

Unwin

COP 400E Co-op Work Program

0

Hours arranged (25-400-001)

Unwin

COP 500E Co-op Work Program

0

Hours arranged (25-500-001)

Unwin

Forest Resources Students Only**COP 100F Co-op Work Program**

0

Hours arranged (25-100-002)

Saylor

COP 200F Co-op Work Program

0

Hours arranged (25-200-002)

Saylor

COP 300F Co-op Work Program

0

Hours arranged (25-300-002)

Saylor

COP 400F Co-op Work Program

0

Hours arranged (25-400-002)

Saylor

COP 500F Co-op Work Program

0

Hours arranged (25-500-002)

Saylor

Humanities and Social Sciences Undergraduate Students Only**COP 100L Co-op Work Program**

0

Hours arranged (25-100-003)

Weston

COP 200L Co-op Work Program

0

Hours arranged (25-200-003)

Weston

COP 300L Co-op Work Program

0

Hours arranged (25-300-003)

Weston

COP 400L Co-op Work Program

0

Hours arranged (25-400-003)

Weston

COP 500L Co-op Work Program

0

Hours arranged (25-500-003)

Weston

Physical and Mathematical Sciences Undergraduate Students Only

COP 100P Co-op Work Program	0
Hours arranged (25-100-004)	Weston
COP 200P Co-op Work Program	0
Hours arranged (25-200-004)	Weston
COP 300P Co-op Work Program	0
Hours arranged (25-300-004)	Weston
COP 400P Co-op Work Program	0
Hours arranged (25-400-004)	Weston
COP 500P Co-op Work Program	0
Hours arranged (25-500-004)	Weston

Textiles Undergraduate Students Only

COP 100T Co-op Work Program	0
Hours arranged (25-100-005)	Mohamed
COP 200T Co-op Work Program	0
Hours arranged (25-200-005)	Mohamed
COP 300T Co-op Work Program	0
Hours arranged (25-300-005)	Mohamed
COP 400T Co-op Work Program	0
Hours arranged (25-400-005)	Mohamed
COP 500T Co-op Work Program	0
Hours arranged (25-500-005)	Mohamed

Agriculture and Life Sciences Undergraduate Students Only

COP 100A Co-op Work Program	0
Hours arranged (25-100-006)	Weston
COP 200A Co-op Work Program	0
Hours arranged (25-200-006)	Weston
COP 300A Co-op Work Program	0
Hours arranged (25-300-006)	Weston
COP 400A Co-op Work Program	0
Hours arranged (25-400-006)	Weston
COP 500A Co-op Work Program	0
Hours arranged (25-500-006)	Weston

Design Undergraduate Students Only

COP 100D Co-op Work Program	0
Hours arranged (25-100-007)	Weston
COP 200D Co-op Work Program	0
Hours arranged (25-200-007)	Weston
COP 300D Co-op Work Program	0
Hours arranged (25-300-007)	Weston
COP 400D Co-op Work Program	0
Hours arranged (25-400-007)	Weston

COP 500D Co-op Work Program	0
Hours arranged (25-500-007)	Weston
Education Undergraduate Students Only	
COP 100W Co-op Work Program	0
Hours arranged (25-100-008)	Weston
COP 200W Co-op Work Program	0
Hours arranged (25-200-008)	Weston
COP 300W Co-op Work Program	0
Hours arranged (25-300-008)	Weston
COP 400W Co-op Work Program	0
Hours arranged (25-400-008)	Weston
COP 500W Co-op Work Program	0
Hours arranged (25-500-008)	Weston
Graduate Students Only	
COP 500N Co-op Work Program	0
Hours arranged. Full-time Alternating. (25-500-009)	Weston
COP 500R Co-op Work Program	0
Hours arranged. Part-time Parallel. (25-500-010)	Weston

Crop Science

FIRST SESSION	
CS 591 Special Problems	Credits Arranged
Prerequisite: Consent of Instructor	
Hours arranged (24-591-001)	Emery
CS 699 Research	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (24-699-001)	Emery
SECOND SESSION	
CS 591 Special Problems	Credits Arranged
Prerequisite: Consent of Instructor	
Hours arranged (24-591-001)	Emery
CS 699 Research	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (24-699-001)	Emery

Computer Science

TEN-WEEK SESSION	
CSC 101E Introduction to Programming	3
Prerequisite: MA 111	
LR 1745-1930 MW (23-101-001)	Williamson
LB 1945-2130 MW (23-101-101) (23-101-102) (23-101-103) (23-101-104)	
(23-101-105) (23-101-106)	
CSC 102E Programming Concepts	3
Prerequisite: CSC 101	
1745-1930 TuTh (23-102-001)	Blue
1945-2130 TuTh (23-102-002)	Blue

CSC 111 Introduction to FORTRAN Programming	2
Prerequisite: MA 111 or equivalent recommended	
0950-1120 TuTh (23-111-001)	Cody
CSC 200A Introduction to Computers and Their Uses	3
0950-1120 MW (23-200-001)	Hodges
NOTE: Students registering for CSC 200A must also register for CSC 200X	
CSC 200X Introduction to Computers Laboratory	0
0900-1200 Tu (23-200-101)	
0900-1200 Th (23-200-102)	
1300-1600 M (23-200-103)	
1300-1600 Tu (23-200-104)	
1300-1600 W (23-200-105)	
1300-1600 Th (23-200-106)	
CSC 200B Introduction to Computers and Their Uses	3
1745-1915 MW (23-200-002)	Hodges
NOTE: Students registering for CSC 200B must also register for CSC 200Y	
CSC 200Y Introduction to Computers Laboratory	0
1930-2230 M (23-200-107)	
1745-2045 Tu (23-200-108)	
1930-2230 W (23-200-109)	
1745-2045 Th (23-200-110)	
CSC 201E Basic Computer Organization and Assembly Language	3
Prerequisite: CSC 101 or CSC 111	
1745-1930 MW (23-201-001)	Worth
1945-2130 MW (23-201-002)	Worth
CSC 252E Principles of Programming COBOL	1
Prerequisite: CSC 101	
1745-1845 TuTh (23-252-001)	Sechrist
CSC 302 Introduction to Numerical Methods	3
Prerequisite: CSC 101 or CSC 111	
1020-1205 MW (23-302-001)	Reid
CSC 311E Data Structures	3
Prerequisites: CSC 102 and CSC 201	
1745-1930 MW (23-311-001)	Lang
1945-2130 MW (23-311-002)	Lang
CSC 312 Computer Organization and Logic	4
Prerequisites: CSC 201 and CSC 322	
LR 1340-1550 MW (23-312-001)	Taylor
LB 1340-1550 Th (23-312-101)	

Computer Studies

FIRST SESSION

CSE 457 Electric Circuits	1
Prerequisites: MA 202, PY 208 and B average in MA and PY	
0800-0900 (09-457-001)	Staff
May 23-June 7—Two and One-Half Week Course—Final Exam June 8	
CSE 458 Electronic Circuits	1
Prerequisite: CSE 457	
0800-0900 (09-458-001)	Staff
June 11-June 26—Two and One-Half Week Course—Final Exam June 27	

CSE 506 Digital Systems Architecture	3
Prerequisite: ECE 340 or CSC 312 or CSE 454	
1140-1310 (09-506-001)	Mehrotra

TEN-WEEK SESSION

CSE 452 Assembly Language and Basic Computer Organization	1
Prerequisites: CSC 101 or equivalent and Consent of Instructor	
For Computer Studies majors or minors and Electrical and Computer Engineering graduate students. Other graduate students as appropriate.	
1745-1930 MW (09-452-001)	Worth
CSE 453 Data Structures	1
Prerequisites: CSC 101 for equivalent and Consent of Instructor	
For Computer Studies majors or minors and Electrical and Computer Engineering graduate students. Other graduate students as appropriate.	
1945-2130 MW (09-453-001)	Lang

Design

FIRST SESSION

DN 411F Advanced Visual Laboratory (Drawing)	3
Prerequisites: DF 102, Sophomore standing	
0850-1250 (26-411-001)	Toplikar
*DN 494A Internship in Design	1-3
Prerequisites: Junior standing and approval of program director.	
Maximum 6 credit hours.	
Hours arranged	Burns
*DN 494B Internship in Design	1-3
Prerequisites: Junior standing and approval of program director.	
Maximum 6 credit hours.	
Hours arranged	Sullivan
*DN 494C Internship in Design	1-3
Prerequisites: Junior standing and approval of program director.	
Maximum 6 credit hours.	
Hours arranged	Foote
*DN 495A Independent Study in Design	1-3
Prerequisites: Junior standing. Approval of program director and core chairman.	
Maximum 6 credit hours.	
Hours arranged	Burns
*DN 495B Independent Study in Design	1-3
Prerequisites: Junior standing. Approval of program director and core chairman.	
Maximum 6 credit hours.	
Hours arranged	Sullivan
*DN 495C Independent Study in Design	1-3
Prerequisites: Junior standing. Approval of program director and core chairman.	
Maximum 6 credit hours.	
Hours arranged	Foote
DN 698 Design Research and Service Learning Projects	2-6
Prerequisites: Graduate standing, consent of program director and Graduate Committee.	
Hours arranged (26-698-001)	Burns

* Students may not preregister for this course. Course may be added on Registration Day, May 22.

SECOND SESSION

*DN 494A Internship in Design	1-3
Prerequisites: Junior standing and approval of program director.	
Maximum 6 credit hours.	
Hours arranged	Burns
*DN 494B Internship in Design	1-3
Prerequisites: Junior standing and approval of program director.	
Maximum 6 credit hours.	
Hours arranged	Sullivan
*DN 494C Internship in Design	1-3
Prerequisites: Junior standing and approval of program director.	
Maximum 6 credit hours.	
Hours arranged	Foote
*DN 495A Independent Study in Design	1-3
Prerequisites: Junior standing. Approval of program director and core chairman.	
Maximum 6 credit hours.	
Hours arranged	Burns
*DN 495B Independent Study in Design	1-3
Prerequisites: Junior standing and approval of program director and core chairman.	
Maximum 6 credit hours.	
Hours arranged	Sullivan
*DN 495C Independent Study in Design	1-3
Prerequisites: Junior standing and approval of program director and core chairman.	
Maximum 6 credit hours.	
Hours arranged	Foote

* Students may not preregister for this course. Course may be added on Registration Day, July 5.

Economics and Business

FIRST SESSION

EB 201 Economics I	3
Credit will not be awarded for both EB 201 and EB 212. Students interested in Agriculture and Natural Resources should enroll in EB 212 instead of this course.	
0800-0930 (27-201-001)	Staff
0800-0930 (27-201-002)	Wessels
0950-1120 (27-201-003)	Ball
0950-1120 (27-201-004)	Wessels
1140-1310 (27-201-005)	Staff
EB 202 Economics II	3
Prerequisite: EB 201 or EB 212	
0800-0930 (27-202-001)	Staff
0950-1120 (27-202-002)	Staff
EB 301 Intermediate Microeconomics	3
Prerequisites: MA 113 or MA 112; EB 201 or EB 212	
0800-0930 (27-301-001)	Dutton
0950-1120 (27-301-002)	Grennes
EB 302 Intermediate Macroeconomics	3
Prerequisites: MA 113 or MA 112; EB 201 or EB 212	
0950-1120 (27-302-001)	Wilson

EB 313 Marketing Methods	3
Prerequisite: EB 201 or EB 212	
0950-1120 (27-313-001)	Gerstner
1340-1510 (27-313-002)	Gerstner
EB (ST) 350 Economics and Business Statistics	3
Prerequisites: MA 113 or MA 112; MA 114; EB 201 and EB 202 or equivalent	
0800-0930 (27-350-001)	Wilson
EB (HI) 370 The Rise of Industrialism	3
Prerequisite: EB 201 or EB 212	
0950-1120 (27-370-001)	D. Fisher
EB 371 Evolution of the American Economy	3
Prerequisite: EB 201 or EB 212	
0800-0930 (27-371-001)	Ball
EB 404 Money, Financial Markets, and the Economy	3
Prerequisite: EB 302	
1140-1310 (27-404-001)	D. Fisher
EB 410 Public Finance	3
Prerequisite: EB 301	
0800-0930 (27-410-001)	Knoeber
0950-1120 (27-410-002)	Knoeber
EB 422 Investments and Portfolio Management	3
Prerequisites: EB 201 or EB 212; EB 350 or a grade of C or better in ST 311	
1140-1310 (27-422-001)	M. Fisher
EB 435 Urban Economics	3
Prerequisite: EB 301	
0950-1120 (27-435-001)	Margolis
EB 448 International Economics	3
Prerequisite: EB 301	
0800-0930 (27-448-001)	Grennes
EB 501 Price Theory	3
Prerequisites: MA 113 and EB 301	
0950-1120 (27-501-001)	Dutton
EB 598 Topical Problems in Economics	1-6
Prerequisite: Consent of Instructor	
Hours arranged (27-598-001)	Staff
EB 640 Advanced Economic Development	3
Prerequisites: EB 501, EB 502, EB 540	
0800-1000 MWF (27-640-001)	King/Coutu
May 23-July 6—Six Week Course—Final Exam July 6	
EB 699 Research in Economics	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (27-699-001)	Graduate Staff
SECOND SESSION	
EB 201 Economics I	3
Credit will not be awarded for both EB 201 and EB 212. Students interested in Agriculture and Natural Resources should enroll in EB 212 instead of this course.	
0800-0930 (27-201-001)	Staff
0950-1120 (27-201-002)	Staff
0950-1120 (27-201-003)	Staff

EB 202 Economics II	3
Prerequisite: EB 201 or EB 212	
0800-0930 (27-202-001)	Staff
0950-1120 (27-202-002)	Staff
EB 212 Economics of Agriculture	3
Prerequisite: MA 111	
Credit will not be awarded for both EB 201 and EB 212	
0950-1120 (27-212-001)	Peeler
EB 301 Intermediate Microeconomics	3
Prerequisites: MA 113 or MA 112; EB 201 or EB 212	
0950-1120 (27-301-001)	Levedahl
EB 302 Intermediate Macroeconomics	3
Prerequisites: MA 113 or MA 112, EB 201 or EB 212	
0800-0930 (27-302-001)	Staff
EB 313 Marketing Methods	3
Prerequisite: EB 201 or EB 212	
0800-0930 (27-313-001)	Levedahl
0950-1120 (27-313-002)	Staff
EB 325 Industrial Management	3
Prerequisite: EB 201 or EB 212.	
1140-1310 (27-325-001)	Newmark
EB 413 Competition, Monopoly and Public Policy	3
Prerequisite: EB 301	
0950-1120 (27-413-001)	Newmark
EB 420 Corporation Finance	3
Prerequisites: EB 201 or EB 212 and ACC 260 or ACC 265	
0950-1120 (27-420-001)	Staff
1140-1310 (27-420-002)	Staff
EB 598 Topical Problems in Economics	1-6
Prerequisite: Consent of Instructor	
Hours arranged (27-598-001)	Staff
EB 699 Research in Economics	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (27-699-001)	Staff
TEN-WEEK SESSION	
EB 307E Business Law I	3
Prerequisite: EB 201 or EB 212	
Credit for both EB 306 and EB 307 is not allowed.	
1945-2130 MW (27-307-001)	Huggard
1745-1930 TuTh (27-307-002)	Staff
EB 308E Business Law II	3
Prerequisite: EB 307	
1745-1930 MW (27-308-001)	Huggard
EB 502E Income and Employment Theory	3
Prerequisites: MA 113, EB 301 and EB 302	
1745-1930 MW (27-502-001)	M. Fisher

EB 625E Long Range Planning in Business and Industry	3
Prerequisite: EB 501	
1745-1930 TuTh (27-625-001)	Holthausen
ADULT EDUCATION SESSION	
EB 401 Economic Analysis for Nonmajors	3
Prerequisite: EB 201 or EB 212	
0900-1200 (27-401-001)	Johnson
EB 403 Economics of Family Decisions	3
Prerequisite: EB 201 or EB 212 or equivalent	
1330-1630 (27-403-001)	Walden
EB 521 Markets and Trade	3
Prerequisite: EB 301 or EB 401	
0900-1200 (27-521-001)	Dahle

Electrical and Computer Engineering

FIRST SESSION

ECE 301 Linear Systems	3
Prerequisite: A grade of C or better in ECE 202	
0800-0930 (30-301-001)	Staff
ECE 331 Principles of Electrical Engineering I	3
Prerequisites: MA 201, PY 208	
Not available to ECE and CPE majors	
0950-1120 (30-331-001)	Staff
ECE 435 Elements of Control	3
Prerequisites: ECE 301, ECE 302, ECE 314	
0800-0930 (30-435-001)	Rastgoufard
ECE 513 Digital Signal Processing	3
Prerequisites: ECE 301, ECE 302 or Consent of Instructor, B average in ECE and MA	
0950-1120 (30-513-001)	S. T. Alexander
ECE 699 Electrical Engineering Research	Credits Arranged
Prerequisite: Graduate standing in Electrical and Computer Engineering and approval of advisor	
Hours arranged (30-699-001)	Staff

SECOND SESSION

ECE 302 Numerical Applications in Electrical Engineering	3
Prerequisites: CSC 111, a grade of C or better in ECE 202	
0800-0930 (30-302-001)	Staff
ECE 332 Principles of Electrical Engineering II	3
Prerequisite: ECE 331	
Not available to ECE and CPE majors	
0950-1120 (30-332-001)	Staff
ECE 699 Electrical Engineering Research	Credits Arranged
Prerequisite: Graduate standing in Electrical and Computer Engineering and approval of advisor	
Hours arranged (30-699-001)	Staff

TEN-WEEK SESSION

ECE 202 Electric Circuits II

4

Prerequisite: A grade of C or better in ECE 201

LR 0800-0900 (30-202-001)

Staff

LB 1020-1120 (30-202-002)

Staff

LB 1135-1425 M (30-202-101)

LB 1445-1735 M (30-202-102)

LB 1755-2045 M (30-202-103)

LB 1135-1425 Tu (30-202-104)

LB 1445-1735 Tu (30-202-105)

LB 1755-2045 Tu (30-202-106)

LB 1135-1425 W (30-202-107)

LB 1445-1735 W (30-202-108)

LB 1135-1425 Th (30-202-109)

LB 1445-1735 Th (30-202-110)

LB 1135-1425 F (30-202-111)

LB 1445-1735 Th (30-202-112)

School of Education

FIRST SESSION

ED 203 Introduction to Teaching Mathematics

3

0800-1140 (28-203-001)

Anderson

ED 296 Special Topics in Education

1-3

Hours arranged (28-296-001)

Staff

ED 344 School and Society

3

Prerequisite: Junior or senior standing

1340-1510 (28-344-001)

Staff

ED 496 Special Topics in Education

1-3

Prerequisites: Junior or senior standing and Consent of Instructor

Hours arranged (28-496-001)

Staff

ED 511 Implications of Mathematical Content, Structure and Processes for the Teaching of Mathematics in the Elementary School

3

Prerequisite: Bachelor's degree in elementary education or Consent of Instructor

1600-1930 TuTh (28-511-001)

Kolb

ED 513E Introduction to Issues and Techniques in Visual Impairments

3

Prerequisite: ED 506

1600-1930 MW (28-513-001)

Zambone

ED 526 Teaching in College

3

1340-1510 (28-526-001)

Anderson

ED 530E Theories and Techniques of Counseling

3

Prerequisite: Six hours of ED or PSY

Corequisite: ED 520 or equivalent

1600-1930 TuTh (28-530-001)

Gerler

ED 533E Group Counseling

3

Prerequisite: ED 530

1600-1930 MW (28-533-001)

Gerler

ED 540E Career/Vocational Education for the Handicapped

3

Prerequisites: ED 506 and ED 527 or Consent of Instructor

1600-1930 TuTh (28-540-001)

Hughes

ED 541A Practicum in Occupational Education	Maximum 6
Prerequisite: Graduate standing or PBS status	
Hours arranged (28-541-001)	Clary
ED 541B Practicum in Education Administration	3
Prerequisite: Graduate standing or PBS status	
Hours arranged (28-541-002)	Staff
ED 594 Special Problems in Science Teaching	1-3
Prerequisite: ED 476 or equivalent	
Hours arranged (28-594-001)	Staff
ED 596 Topical Problems in Adult and Community College Education	Credits Arranged
Prerequisite: Graduate standing or PBS status	
Hours arranged (28-596-001)	Staff
ED 596A Topical Problems in Adult and Community College Education—Education for Retirement	3
Prerequisite: Graduate standing or PBS status	
0800-0930 (28-596-002)	Glass
ED 596B Topical Problems in Adult and Community College Education—Group Work in Adult Education	3
Prerequisite: Graduate standing or PBS status	
1140-1310 (28-596-003)	Glass
ED 597 Special Problems in Education	1-3
Prerequisite: Graduate standing or PBS status	
Hours arranged (28-597-001)	Staff
ED 598 Special Problems in Curriculum and Instruction	1-6
Prerequisites: 6 hours of ED or PSY and Consent of Instructor	
Hours arranged (28-598-001)	Staff
ED 598F Special Problems in Curriculum and Instruction—Alternatives in Middle Years Education	3
Prerequisites: 6 hours of ED or PSY and Consent of Instructor	
0930-1600 (28-598-002)	
0930-1600 (28-598-003)	Arnold Stevenson
June 18-June 29 (see "Special Courses and Institutes," p. 27)	
ED 598T Special Problems in Curriculum and Instruction—Computer Applications in Language Arts	2
Prerequisites: 6 hours of ED or PSY and Consent of Instructor	
0900-1300 (28-598-004)	Staff
June 18-June 29	
ED 599 Research Projects in Education	1-3
Prerequisites: Consent of Instructor, ED 532 or equivalent	
Hours arranged (28-599-001)	Staff
ED 599A Research Projects in Education	3
Prerequisites: Consent of Instructor, ED 532 or equivalent	
Hours arranged (28-599-002)	Staff
ED 621 Internship in Education	3-9
Prerequisites: Nine credit hours in graduate level courses and Consent of Instructor	
Hours arranged (28-621-001)	Staff

ED 636 Observation and Supervised Field Work	3
Prerequisite: Consent of Instructor	
Hours arranged (28-636-001)	Sprinthall
ED 699 Thesis and Dissertation Research	Credits Arranged
Prerequisites: 15 hours of Education, Consent of Instructor	
Hours arranged (28-699-001)	Staff
ED 699A Thesis and Dissertation Research— Adult and Community College Education	Credits Arranged
Prerequisites: 15 hours of Education, Consent of Instructor	
Hours arranged (28-699-002)	Staff
SECOND SESSION	
ED 100 Introduction to Industrial Education	2
0800-1130 (28-100-001)	Foell
July 30-August 10—Two Week Course—Final Exam August 10	
ED 296 Special Topics in Education	1-3
Hours arranged (28-296-001)	Staff
ED 305 Analysis of Technical Education Programs and Course Construction	3
Prerequisite: ED 100 or equivalent	
0800-1130 (28-305-001)	Foell
July 6-July 25—Two and One-Half Week Course—Final Exam July 25	
ED 496 Special Topics in Education	1-3
Prerequisites: Junior or Senior standing and Consent of Instructor	
Hours arranged (28-496-001)	Staff
ED 496A Special Topics in Education—American Culture	3
Prerequisites: Junior or senior standing and Consent of Instructor	
1340-1510 (28-496-002)	Staff
ED 506 Education of Exceptional Children	3
Prerequisite: 9 hours of ED or PSY	
0800-0930 (28-506-001)	Hall
ED 512 Teaching Mathematics in Elementary and Junior High School	3
Prerequisite: ED 471 or equivalent	
1140-1310 (28-512-001)	Watson
ED 531 Mental Retardation	3
Prerequisite: ED 506 or Consent of Instructor	
0950-1120 (28-531-001)	Hall
ED 532 Introduction to Educational Inquiry	3
Prerequisite: Graduate standing or PBS status	
0800-0930 (28-532-001)	Davies
0950-1120 (28-532-002)	Davies
ED 541A Practicum in Occupational Education	Maximum 6
Prerequisite: Graduate standing or PBS status	
Hours arranged (28-541-001)	Clary
ED 541B Practicum in Education Administration	3
Prerequisite: Graduate standing or PBS status	
Hours arranged (28-541-002)	Staff
ED 570 Foundations of Mathematics Education	3
Prerequisite: ED 471 or equivalent	
1140-1310 (28-570-001)	Waters

ED 577 Improving Classroom Instruction in Science	3
Prerequisite: ED 475 or equivalent	
0950-1120 (28-577-001)	Wheatley
ED 592 Special Problems in Mathematics Teaching: Microcomputers in the Classroom	3
Prerequisite: ED 471 or equivalent	
1340-1620 MWTh (28-592-001)	Staff
ED 592A Special Problems in Mathematics Teaching: Fundamental Math I—Concepts and Statistics for Teaching	1-3
Prerequisite: ED 471 or equivalent	
0800-0930 (28-592-002)	Staff
ED 592B Special Problems in Mathematics Teaching: Fundamental Math II—Concepts and Statistics for Teaching	1-3
Prerequisite: ED 471 or equivalent	
0930-1140 (28-592-003)	Staff
ED 593C Special Problems in Agricultural Education: Teaching Vocational Agriculture	3
Prerequisites: Six hours graduate credit in Agricultural Education and Consent of Instructor.	
1340-1630 (28-593-001)	Moss
July 5-July 24—Two and One-Half Week Course—Final Exam July 24	
ED 593D Special Problems in Agricultural Education: Occupational/Community Surveys	3
Prerequisites: Six hours graduate credit in Agricultural Education and Consent of Instructor.	
1340-1630 (28-593-002)	Moss
July 25-August 10—Two and One-Half Week Course—Final Exam August 10	
ED 594 Special Problems in Science Teaching	1-3
Prerequisite: ED 476 or equivalent	
Hours arranged (28-594-001)	Staff
ED 594A Special Problems in Science Teaching: Teaching Environmental and Natural History Education	3
<i>Regular class sessions plus fieldwork.</i>	
Prerequisite: ED 476 or equivalent	
1340-1510 (28-594-002)	Wheatley
ED 594B Special Problems in Science Teaching	6
<i>(Open only to participants in the NSF Honors Recognition Workshop)</i>	
Prerequisite: ED 476 or equivalent	
Hours arranged (28-594-003)	Anderson
ED 596 Topical Problems in Adult and Community College Education	Credits Arranged
Prerequisite: Graduate standing or PBS status	
Hours arranged (28-596-001)	Staff
ED 597 Special Problems in Education	1-6
Prerequisite: Graduate standing or PBS status	
Hours arranged (28-597-001)	Staff
ED 598 Special Problems in Curriculum and Instruction	1-6
Prerequisites: Six hours of ED or PSY and Consent of Instructor	
Hours arranged (28-598-001)	Staff

ED 598D Special Problems in Curriculum and Instruction: Teaching of Writing Institute	6
Prerequisites: Six hours of ED or PSY and Consent of Instructor 0815-1530 (28-598-002)	Pritchard
0815-1530 (28-598-003)	Buckner
June 25-July 24—Four Week Course—Final Exam July 24	
ED 598S Special Problems in Curriculum and Instruction: Outdoor Education for Handicapped	3
Prerequisites: Six hours of ED or PSY and Consent of Instructor 0900-1600 (28-598-004)	Hughes
July 16-July 27—Two Week Course—Final Exam July 27	
ED 598Y Special Problems in Curriculum and Instruction: Appropriate Services in Education for the Gifted	3
Prerequisites: Six hours of ED or PSY and Consent of Instructor 0900-1200 (28-598-005)	Aubrecht
July 6-July 26—Three Week Course—Final Exam July 26	
ED 598K Special Problems in Curriculum and Instruction: Education for the Gifted—International Perspective	3
Prerequisites: Six hours of ED or PSY and Consent of Instructor 1300-1600 (28-598-006)	Long
July 6-July 26—Three Week Course—Final Exam July 26	
ED 599 Research Projects in Education	1-3
Prerequisites: Consent of Instructor, ED 532 or equivalent Hours arranged (28-599-001)	Staff
ED 599A Research Projects in Education: Adult and Community College Education	3
Prerequisites: Consent of Instructor, ED 532 or equivalent Hours arranged (28-599-002)	Staff
ED 621 Internship in Education	3-9
Prerequisites: Nine credit hours in graduate level courses and Consent of Instructor Hours arranged (28-621-001)	Staff
ED 699 Thesis and Dissertation Research	Credits Arranged
Prerequisites: 15 hours of Education, Consent of Instructor Hours arranged (28-699-001)	Staff
ED 699A Thesis and Dissertation Research: Adult and Community College Education	Credits Arranged
Prerequisites: 15 hours of Education, Consent of Instructor Hours arranged (28-699-002)	Staff
TEN-WEEK SESSION	
ED 581 Curriculum and Instruction in the Allied Health Professions	3
Prerequisites: Advanced undergraduate or graduate standing and Consent of Instructor 1745-1930 (28-581-001)	Davis
ADULT EDUCATION SESSION	
ED 596A Topical Problems in Adult and Community College Education: The Community Practice of Adult Education	3
Prerequisite: Graduate standing or PBS status 0900-1200 (28-596-002)	Griffith

ED 596B Topical Problems in Adult and Community College Education: Current Issues in Community Colleges—Effects of Economic Conditions	1
Prerequisite: Graduate standing or PBS status	
1300-1600 (28-596-003)	Alfred
July 9-July 13	
ED 596C Topical Problems in Adult and Community College Education: Current Issues in Community Colleges—Changing Patterns of Governance	1
Prerequisite: Graduate standing or PBS status	
1300-1600 (28-596-004)	Alfred
July 16-July 20	
ED 596D Topical Problems in Adult and Community College Education: Current Issues in Community Colleges—Assessment of Outcomes	1
Prerequisite: Graduate standing or PBS status	
1300-1600 (28-596-005)	Alfred
July 23-July 27	
ED 596F Topical Problems in Adult and Community College Education: Evaluation and Accountability—Measurement	1
Prerequisite: Graduate standing or PBS status	
0800-1200 (28-596-006)	Mustian
July 9-July 13	
ED 596G Topical Problems in Adult and Community College Education: Evaluation and Accountability—Data Collection/Reduction	1
Prerequisite: Graduate standing or PBS status	
0800-1200 (28-596-007)	Mustian
July 16-July 20	
ED 596H Topical Problems in Adult and Community College Education: Evaluation and Accountability—Analysis and Interpretation	1
Prerequisite: Graduate standing or PBS status	
0800-1200 (28-596-008)	Mustian
July 23-July 27	
ED 596I Topical Problems in Adult and Community College Education: Effective Communication Skills Training for Managers I	1
Prerequisite: Graduate standing or PBS status	
1300-1600 (28-596-009)	Leonard
July 9-July 13	
ED 596J Topical Problems in Adult and Community College Education: Effective Communication Skills Training for Managers II	1
Prerequisite: Graduate standing or PBS status	
1300-1600 (28-596-010)	Anderson
July 16-July 20	

English

FIRST SESSION

FRESHMAN ENGLISH

ENG 111 Composition and Rhetoric	3
General University requirement.	
Successful completion of ENG 111 requires a grade of C or better.	
0800-0930 (36-111-001)	Staff
0950-1120 (36-111-002)	Staff
1140-1310 (36-111-003)	Staff

ENG 112 Composition and Reading	3
General University requirement.	
Prerequisite: A grade of C or better in ENG 111.	
0800-0930 (36-112-001)	Staff
0950-1120 (36-112-002)	Staff
1140-1310 (36-112-003)	Staff

WRITING AND LANGUAGE

The prerequisite for all courses in writing and language at the 200-level and above is the completion of ENG 111 and ENG 112.

ENG 214 Copyediting	3
1140-1310 (36-214-001)	Kelton

ENG 215 Principles of News and Article Writing	3
0950-1120 (36-215-001)	Rudner

ENG 221 Communication for Business and Management	3
0800-0930 (36-221-001)	Kelton

ENG 321 The Communication of Technical Information	3
Prerequisite: Junior standing.	
0800-0930 (36-321-001)	Thompson-Jones
0950-1120 (36-321-002)	J. Register
1140-1310 (36-321-003)	J. Register

LITERATURE

The prerequisite for all 200-level literature courses is the completion of ENG 111 and ENG 112.

ENG 205 Studies in Great Works of Literature	3
The courses ENG 205, ENG 206, ENG 207, and ENG 208 are designed for students not enrolled in Humanities and Social Sciences.	
0950-1120 (36-205-001)	Staff

ENG 208 Studies in Fiction	3
The courses ENG 205, ENG 206, ENG 207, and ENG 208 are designed for students not enrolled in Humanities and Social Sciences.	
0800-0930 (36-208-001)	Staff
0950-1120 (36-208-002)	Staff
1140-1310 (36-208-003)	Staff

ENG 209 Introduction to Shakespeare	3
May not satisfy requirements in the English major.	
0950-1120 (36-209-001)	Blank

ENG 251 Major British Writers	3
Credit will not be given for both ENG 251 and either ENG 261 or ENG 262.	
0800-0930 (36-251-001)	Staff

ENG 252 Major American Writers	3
Credit will not be given for both ENG 252 and either ENG 265 or ENG 266.	
1140-1310 (36-252-001)	Staff

ENG 261 English Literature I	3
0800-0930 (36-261-001)	Staff
1140-1310 (36-261-002)	Staff

ENG 262 English Literature II	3
0950-1120 (36-262-001)	Staff

ENG 265 American Literature I	3
0800-0930 (36-265-001)	Staff
1140-1310 (36-265-002)	Staff
ENG 266 American Literature II	3
0950-1120 (36-266-001)	Staff
ENG 298 Special Projects in English	1-3
Prerequisite: One 200-level course in literature offered by the English Department.	
0800-0930 (36-298-001)	Staff
<i>The prerequisite for all advanced courses in literature is the completion of ENG 111, 112, and one 200-level course in literature offered by the department.</i>	
ENG 463 The Victorian Period	3
1140-1310 (36-463-001)	Harrison
ENG 469 American Realism and Naturalism	3
0800-0930 (36-469-001)	Stein
ENG 498 Special Topics in English	1-6
Prerequisite: Six hours in ENG above the freshman level.	
1140-1310 (36-498-001)	Staff
FOR GRADUATES ONLY	
<i>The prerequisite for all 600-level English courses is graduate standing unless additional prerequisites are noted.</i>	
ENG 662 18th-Century English Literature	3
0950-1120 (36-662-001)	Moore
ENG 698 Bibliography and Methodology	3
Prerequisite: Approved thesis topic.	
Hours arranged (36-698-001)	Thesis Director
ENG 699 Research in Literature (Thesis)	3-5
Prerequisite: Consent of graduate adviser.	
Hours arranged (36-699-001)	Thesis Director
SECOND SESSION	
FRESHMAN ENGLISH	
ENG 110 Developmental English	3
Credit is not applicable toward graduation in any curriculum.	
0800-0930 (36-110-001)	Staff
ENG 111 Composition and Rhetoric	3
General University requirement.	
Successful completion of ENG 111 requires a grade of C or better.	
0800-0930 (36-111-001)	Staff
0950-1120 (36-111-002)	Staff
1140-1310 (36-111-003)	Staff
ENG 112 Composition and Reading	3
General University requirement.	
Prerequisite: A grade of C or better in ENG 111.	
0800-0930 (36-112-001)	Staff
0950-1120 (36-112-002)	Staff
1140-1310 (36-112-003)	Staff

WRITING AND LANGUAGE

The prerequisite for all courses in writing and language at the 200-level and above is the completion of ENG 111 and ENG 112.

ENG 221 Communication for Business and Management 3
0950-1120 (36-221-001) Gordon

ENG 321 The Communication of Technical Information 3
Prerequisite: Junior standing
0800-0930 (36-321-001) Gordon
0950-1120 (36-321-002) Haywood
1140-1310 (36-321-003) Haywood

LITERATURE

The prerequisite for all 200-level literature courses is the completion of ENG 111 and ENG 112.

ENG 205 Studies in Great Works of Literature 3
The courses ENG 205, ENG 206, ENG 207, and ENG 208 are designed for students not enrolled in Humanities and Social Sciences.
0950-1120 (36-205-001) Staff

ENG 208 Studies in Fiction 3
The courses ENG 205, ENG 206, ENG 207, and ENG 208 are designed for students not enrolled in Humanities and Social Sciences.
0800-0930 (36-208-001) Staff
0950-1120 (36-208-002) Staff
1140-1310 (36-208-003) Staff

ENG 209 Introduction to Shakespeare 3
May not satisfy requirements in the English major.
0950-1120 (36-209-001) Hester

ENG 251 Major British Writers 3
Credit will not be given for both ENG 251 and either ENG 261 or ENG 262.
1140-1310 (36-251-001) Staff

ENG 252 Major American Writers 3
Credit will not be given for both ENG 252 and either ENG 265 or ENG 266.
0800-0930 (36-252-001) Staff

ENG 261 English Literature I 3
0950-1120 (36-261-001) Staff

ENG 262 English Literature II 3
0800-0930 (36-262-001) Staff
1140-1310 (36-262-002) Staff

ENG 265 American Literature I 3
0950-1120 (36-265-001) Staff

ENG 266 American Literature II 3
0800-0930 (36-266-001) Staff
1140-1310 (36-266-002) Staff

ENG 298 Special Projects in English 1-3
Prerequisite: One 200-level course in literature offered by the English Department.
0800-0930 (36-298-001) Staff

The prerequisite for all advanced courses in literature is the completion of ENG 111, 112, and one 200-level course in literature offered by the department.

ENG 363 The British Novel of the 19th Century 0800-0930 (36-363-001)	3 King
ENG 398 Contemporary Literature I (1900-1940) 0950-1120 (36-398-001)	3 Jeffers
ENG 498 Special Topics in English Prerequisite: Six hours in ENG above the freshman level. 0950-1120 (36-498-001)	1-6 Staff
FOR GRADUATES ONLY	
<i>The prerequisite for all 600-level English courses is graduate standing unless additional prerequisites are noted.</i>	
ENG 655 American Romantic Period 1140-1310 (36-655-001)	3 West
ENG 698 Bibliography and Methodology Prerequisite: Approved thesis topic. Hours arranged (36-698-001)	3 Thesis Director
ENG 699 Research in Literature (Thesis) Prerequisite: Consent of graduate adviser. Hours arranged (36-699-001)	3-5 Thesis Director
TEN-WEEK SESSION	
FRESHMAN ENGLISH	
ENG 111E Composition and Rhetoric General University requirement. Successful completion of ENG 111 requires a grade of C or better. 1745-1930 MW (36-111-004)	3 Staff
ENG 112E Composition and Reading General University requirement. Prerequisite: A grade of C or better in ENG 111. 1945-2130 MW (36-112-004)	3 Staff
LITERATURE	
<i>The prerequisite for all 200-level literature courses is the completion of ENG 111 and ENG 112.</i>	
ENG 205E Studies in Great Works of Literature The courses ENG 205, ENG 206, ENG 207, and ENG 208 are designed for students not enrolled in Humanities and Social Sciences. 1745-1930 MW (36-205-002)	3 Short
ENG 208E Studies in Fiction The courses ENG 205, ENG 206, ENG 207, and ENG 208 are designed for students not enrolled in Humanities and Social Sciences. 1745-1930 TuTh (36-208-004)	3 Young
ENG 261E English Literature I 1945-2130 MW (36-261-003)	3 Short
ENG 265E American Literature I 1945-2130 TuTh (36-265-003)	3 Young

Entomology

FIRST SESSION

ENT 590 Special Problems

Prerequisite: Consent of Instructor
Hours arranged (38-590-001)

Credits Arranged

Staff

ENT 699 Research

Prerequisite: Graduate standing
Hours arranged (38-699-001)

Credits Arranged

Staff

SECOND SESSION

ENT (ZO) 425 General Entomology

Prerequisite: ZO 201 or equivalent
LR 0800-0900 MWF (38-425-001)
LB 1340-1650 MW (38-425-101)

3

Staff

ENT 590 Special Problems

Prerequisite: Consent of Instructor
Hours arranged (38-590-001)

Credits Arranged

Staff

ENT 699 Research

Prerequisite: Graduate standing
Hours arranged (38-699-001)

Credits Arranged

Staff

Foreign Languages and Literatures

FRENCH

FIRST SESSION

FLF 101 Elementary French I

0800-0930 (64-101-001)
0800-0930 (64-101-002)

3

Malinowski
Holler

FLF 102 Elementary French II

Prerequisite: FLF 101
1140-1310 (64-102-001)
1140-1310 (64-102-002)

3

Witt
Noel

FLF 201 Intermediate French I

Prerequisite: FLF 102 or FLF 105
0950-1120 (64-201-001)
0950-1120 (64-201-002)
0950-1120 (64-201-003)

3

Witt
Malinowski
Holler

SECOND SESSION

FLF 102 Elementary French II

0800-0930 (64-102-001)
0800-0930 (64-102-002)

3

Paschal
Staff

FLF 201 Intermediate French I

Prerequisite: FLS 102 or FLS 105
0950-1120 (64-201-001)
0950-1120 (64-201-002)

3

Paschal
Staff

FLF 202 Intermediate French II

Prerequisite: FLF 201
0800-0930 (64-202-001)

3

Stack

FLF 401 French for Graduate Students	0
Not open to undergraduates.	
0950-1120 (64-401-001)	Stack

GERMAN

FIRST SESSION

FLG 101 Elementary German I	3
1140-1310 (65-101-001)	Rollins
FLG 201 Intermediate German I	3
Prerequisite: FLG 102. Credit for both FLG 201 and FLG 210 is not allowed.	
0950-1120 (65-201-001)	Rollins
FLG 401 German for Graduate Students	0
Not open to undergraduates.	
0800-0930 (65-401-001)	Tucker

SECOND SESSION

FLG 102 Elementary German II	3
Prerequisite: FLG 101	
0950-1120 (65-102-001)	Staff

SPANISH

FIRST SESSION

FLS 101 Elementary Spanish I	3
0950-1120 (68-101-001)	Jezierski
0950-1120 (68-101-002)	Alder
0950-1120 (68-101-003)	Staff
FLS 101E Elementary Spanish I	3
1745-1930 (68-101-004)	Alonzo
FLS 102 Elementary Spanish II	3
Prerequisite: FLS 101	
0800-0930 (68-102-001)	Jezierski
0800-0930 (68-102-002)	Alder
0800-0930 (68-102-003)	Staff
FLS 201 Intermediate Spanish I	3
Prerequisite: FLS 102 or FLS 105	
1140-1310 (68-201-001)	Feeny
1140-1310 (68-201-002)	Staff
FLS 201E Intermediate Spanish I	3
Prerequisite: FLS 102 or FLS 105	
1745-1930 (68-201-003)	Staff
FLS 202 Intermediate Spanish II	3
Prerequisite: FLS 201	
0950-1120 (68-202-001)	Feeny

SECOND SESSION

FLS 101 Elementary Spanish I	3
0800-0930 (68-101-001)	Koike
0800-0930 (68-101-002)	Staff

FLS 102 Elementary Spanish II	3
Prerequisite: FLS 101	
0950-1120 (68-102-001)	Koike
0950-1120 (68-102-002)	Kelly
0950-1120 (68-102-003)	Staff
FLS 102E Elementary Spanish II	3
Prerequisite: FLS 101	
1745-1930 (68-102-004)	Alonso
FLS 201 Intermediate Spanish I	3
Prerequisite: FLS 102 or FLS 105	
1140-1310 (68-201-001)	Cortes
1140-1310 (68-201-002)	Staff
FLS 207 Commercial Spanish	3
Prerequisite: FLS 201 or FLS 205	
0950-1120 (68-207-001)	Cortes
FLS 403 Spanish Prose Fiction to 1900	3
Prerequisite: Consent of the Department	
0800-0930 (68-403-001)	Kelly

Forestry

FIRST SESSION

FOR 111 Introduction to Field Forestry	2
Summer Pre-Camp (May 14-May 25)	
Open only to students transferring to a forestry major.	
0800-1700 (40-111-001)	Gregory/Cooper
FOR 204 Silviculture	2
Summer Camp	
0800-1700 (40-204-001)	Jervis
FOR 261 Forest Biology	2
Summer Camp	
Prerequisites: ENG 112, MA 114, BO 200 or equivalents, FOR 110, FOR 212. Transfer students FOR 111.	
0800-1700 (40-261-001)	Braham
FOR 264 Forest Protection	2
Summer Camp	
Prerequisite: Junior standing in FOR	
0800-1700 (40-264-001)	Farrior/Grand
FOR 274 Mapping and Mensuration	3
Summer Camp	
Prerequisites: MA 114, FOR 110 and FOR 212, FOR 111 for transfer students.	
0800-1700 (40-274-001)	Jervis/Steensen
FOR (FW) 310 Fisheries and Wildlife Inventory and Management	6
(See Fisheries and Wildlife, page 66)	
FOR 491 Senior Problems in Forestry	Credits Arranged
Prerequisite: Consent of department	
Hours arranged (40-491-001)	Staff
FOR 591 Forestry Problems	Credits Arranged
Prerequisite: Advanced undergraduate or graduate standing	
Hours arranged (40-591-001)	Staff

FOR 699 Problems and Research	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (40-699-001)	Staff

SECOND SESSION

FOR 491 Senior Problems in Forestry	Credits Arranged
Prerequisite: Consent of department	
Hours arranged (40-491-001)	Staff

FOR 591 Forestry Problems	Credits Arranged
Prerequisite: Advanced undergraduate or graduate standing	
Hours arranged (40-591-001)	Staff

FOR 699 Problems and Research	Credits Arranged
Hours arranged (40-699-001)	Staff

ADULT EDUCATION SESSION

FOR 591B Private Woodlot Management	3
Prerequisite: Advanced undergraduate or graduate standing	
0800-1700 (40-591-002)	Franklin/Hamilton

Food Science

FIRST SESSION

FS 491 Special Topics in Food Science	1-6
Prerequisites: Twelve hours of Food Science and Consent of Instructor	
Hours arranged (39-491-001)	Staff

FS 591 Special Problems in Food Science	1-6
Prerequisite: Senior or Graduate standing	
Hours arranged (39-591-001)	Staff

FS 691 Special Research Problems in Food Science	Credits Arranged
Hours arranged (39-691-001)	Staff

FS 699 Research in Food Science	Credits Arranged
Hours arranged (39-699-001)	Staff

SECOND SESSION

FS 491 Special Topics in Food Science	1-6
Prerequisite: Twelve hours of Food Science and Consent of Instructor	
Hours arranged (39-491-001)	Staff

FS 591 Special Problems in Food Science	1-6
Prerequisite: Senior or Graduate standing	
Hours arranged (39-591-001)	Staff

FS 691 Special Research Problems in Food Science	Credits Arranged
Hours arranged (39-691-001)	Staff

FS 699 Research in Food Science	Credits Arranged
Hours arranged (39-699-001)	Staff

Fisheries and Wildlife

FIRST SESSION

FW (ZO) 221 Conservation of Natural Resources	3
0950-1120 (51-221-001)	Lacki

FW (FOR) 310 Fisheries and Wildlife Inventory and Management
 Summer Camp
 Prerequisites: FW (ZO) 353 or FW (ZO) 420; Junior or Senior standing
 0800-1700 (51-310-001)

6

Lancia

Graphic Communications

FIRST SESSION

GC 101 Engineering Graphics I

0800-0930 (98-101-001)
 0800-0930 (98-101-002)
 0800-0930 (98-101-003)
 0950-1120 (98-101-004)
 0950-1120 (98-101-005)
 0950-1120 (98-101-006)

2
 Webb
 Vander Wall
 Freeman
 Webb
 Vander Wall
 Freeman

SECOND SESSION

GC 101 Engineering Graphics I

0800-0930 (98-101-001)
 0800-0930 (98-101-002)
 0950-1120 (98-101-003)
 0950-1120 (98-101-004)

2
 Calloway
 Ross
 Calloway
 Ross

Genetics

FIRST SESSION

GN 301 Genetics in Human Affairs

Prerequisite: Students should have Sophomore standing
 0800-0930 (41-301-001)

3
 McKenzie

GN 411 The Principles of Genetics

Prerequisites: BS 100, Junior standing
 1140-1310 (41-411-001)

3
 Staff

GN 695 Special Problems in Genetics

Prerequisites: Advanced Graduate standing and Consent of Instructor
 Hours arranged (41-695-001)

1-3
 Staff

GN 699 Research

Prerequisites: Graduate standing and Consent of Advisor
 Hours arranged (41-699-001)

Credits Arranged
 Staff

SECOND SESSION

GN 695 Special Problems in Genetics

Prerequisites: Advanced Graduate standing and Consent of Instructor
 Hours arranged (41-695-001)

1-3
 Staff

GN 699 Research

Prerequisites: Graduate standing, Consent of Advisor
 Hours arranged (41-699-001)

Credits Arranged
 Staff

History

FIRST SESSION

HI 205 Western Civilization Since 1400

0800-0930 (44-205-001)
 0950-1120 (44-205-002)

3
 Carlton
 Carlton

HI 207 Ancient World to 180 A.D.	3
0950-1120 (44-207-001)	Newby
HI 208 The Middle Ages	3
0800-0930 (44-208-001)	Novak
1140-1310 (44-208-002)	Newby
HI 209 Europe, 1300-1815	3
0950-1120 (44-209-001)	Novak
HI 216 Latin America Since 1826	3
0800-0930 (44-216-001)	Beezley
HI 243 United States, 1845-1914	3
0800-0930 (44-243-001)	J. deTreville
0950-1120 (44-243-002)	J. deTreville
0950-1120 (44-243-003)	Crisp
1140-1310 (44-243-004)	Staff
HI 244 United States Since 1914	3
0800-0930 (44-244-001)	Caddell
0950-1120 (44-244-002)	Caddell
1140-1310 (44-244-003)	Sims
HI 333 History of American Sport	3
0950-1120 (44-333-001)	Beezley
HI 365 The American West	3
1140-1310 (44-365-001)	Crisp
HI 498 Independent Study in History	1-6
Prerequisite: Three hours of History	
Hours arranged (44-498-001)	Staff
HI 598 Special Topics in History	1-6
Prerequisite: Six hours of advanced History or equivalent	
Hours arranged (44-598-001)	Staff
HI 699 Research in History	1-6
Prerequisite: Six hours in advanced History or equivalent	
Hours arranged (44-699-001)	Staff
SECOND SESSION	
HI 205 Western Civilization Since 1400	3
0950-1120 (44-205-001)	Vincent
HI 207 Ancient World to 180 A.D.	3
0800-0930 (44-207-001)	D. deTreville
0950-1120 (44-207-002)	D. deTreville
HI 233 The World in the 20th Century	3
1140-1310 (44-2)	Vincent
HI 242 United States, 1783-1845	3
0800-0930 (44-242-001)	King
HI 243 United States, 1845-1914	3
0950-1120 (44-243-001)	King
0950-1120 (44-243-002)	Smith
0950-1120 (44-243-003)	Staff
1140-1310 (44-243-004)	Smith

HI 244 United States Since 1914	3
0800-0930 (44-244-001)	Harris
0800-0930 (44-244-002)	Sims
1140-1310 (44-244-003)	Sims
HI 446 Civil War and Reconstruction	3
Prerequisite: Three hours of History. Credit will not be given for both HI 446 and HI 546.	
0950-1120 (44-446-001)	Harris
HI 498 Independent Study in History	1-6
Prerequisite: Three hours of History	
Hours arranged (44-498-001)	Staff
HI 546 Civil War and Reconstruction	3
Prerequisite: Six hours of advanced History. Credit will not be given for both HI 446 and HI 546.	
0950-1120 (44-546-001)	Harris
HI 598 Special Topics in History	1-6
Prerequisite: Six hours of advanced History or equivalent	
Hours arranged (44-598-001)	Staff
HI 699 Research in History	1-6
Prerequisite: Six hours in advanced History or equivalent	
Hours arranged (44-699-001)	Staff

Horticultural Science

FIRST SESSION

HS 101 Plants for Home and Pleasure	3
LR 0910-1010 (45-101-001)	Lane
LB 1340-1650 TuTh (45-101-101)	
HS 495 Special Topics in Horticultural Science	1-6
Hours arranged (45-495-001)	Staff
HS 595 Special Topics in Horticultural Science	1-6
Prerequisite: Consent of Instructor	
Hours arranged (45-595-001)	Staff
HS 599 Research Principles	1-6
Prerequisite: Consent of Instructor	
Hours arranged (45-599-001)	Staff
HS 695 Graduate Topics in Horticultural Science	1-6
Prerequisite: Consent of Instructor	
Hours arranged (45-695-001)	Staff
HS 699 Research	Credits Arranged
Prerequisites: Graduate Standing in Horticulture, Consent of Advisory Committee Chair-	
man	
Hours arranged (45-699-001)	Staff

SECOND SESSION

HS 495 Special Topics in Horticultural Science	1-6
Hours arranged (45-495-001)	Staff
HS 495H Special Topics in Horticultural Science:	3
Interior Plant Management	
LR 0910-1010 (45-495-002)	Lane
LB 1340-1650 TuTh (45-495-101)	

HS 595 Special Topics in Horticultural Science	1-6
Prerequisite: Consent of Instructor	
Hours arranged (45-595-001)	Staff
HS 599 Research Principles	1-6
Prerequisite: Consent of Instructor	
Hours arranged (45-599-001)	Staff
HS 695 Graduate Topics in Horticultural Science	1-6
Prerequisite: Consent of Instructor	
Hours arranged (45-695-001)	Staff

HS 699 Research	Credits Arranged
Prerequisites: Graduate standing in Horticulture, Consent of Advisory Committee Chairman	
Hours arranged (45-699-001)	Staff

ADULT EDUCATION SESSION

HS 562 Postharvest Physiology	3
Prerequisites: BO 421, Special arrangement with instructor	
0800-1600 (45-562-001)	Wilson
July 9-July 20	

Industrial Arts

FIRST SESSION

IA 115 Wood Processing I	3
0730-1010 (47-115-001)	Cox
IA 122 Metal Technology I	3
1020-1310 (47-122-001)	Wenig
IA 368 Technical Drawing II	3
Prerequisite: GC 101	
1020-1310 (47-368-001)	Troxler
IA 590 Laboratory Problems in Industrial Arts	3
Prerequisites: Senior Standing, Consent of Instructor	
0800-1700 (47-590-001)	Young
June 14-June 27—Two Week Course	

Industrial Engineering

FIRST SESSION

IE 311 Engineering Economic Analysis	3
Prerequisite: MA 102 (non-engineering students may use MA 112 or MA 113)	
0800-0930 (49-311-001)	Bernhard
IE 495 Project Work in Industrial Engineering	1-6
Prerequisite: Senior standing	
Hours arranged (49-495-001)	Staff
IE 591 Project Work	1-6
Prerequisite: Graduate standing	
Hours arranged (49-591-001)	Staff
IE 651 Special Studies in Industrial Engineering	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (49-651-001)	Staff

IE 699 Industrial Engineering Research	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (49-699-001)	Staff
SECOND SESSION	
IE 307 Business Data Processing	3
Prerequisite: CSC 111 or equivalent	
0950-1120 (49-307-001)	Taheri
IE 308 Control of Production and Service Systems	4
Prerequisites: IE 307, ST 372; Corequisite: IE 352	
LR 0800-0930 (49-308-001)	Taheri
PR 1340-1510 TuTh (49-308-201)	
IE 311 Engineering Economic Analysis	3
Prerequisite: MA 102 (non-engineering students may use MA 112 or MA 113)	
0800-0930 (49-311-001)	Prak
IE 443 Quality Control	3
Prerequisite: ST 361	
LR 0800-0930 (49-443-001)	Usher
PR 1340-1550 MW (49-443-201)	
IE 495 Project Work in Industrial Engineering	1-6
Prerequisite: Senior standing	
Hours arranged (49-495-001)	Staff
IE 591 Project Work	1-6
Prerequisite: Graduate standing	
Hours arranged (49-591-001)	Staff
IE 651 Special Studies in Industrial Engineering	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (49-651-001)	Staff
IE 699 Industrial Engineering Research	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (49-699-001)	Staff
TEN-WEEK SESSION	
IE 641 Environmental Factors and Human Performance	3
Prerequisites: IE (PSY) 540 and IE 542 or other equivalent	
0900-1045 MF (49-641-001)	Pearson

Landscape Architecture

FIRST SESSION

*LAR 595 Independent Study	1-3
Prerequisite: Graduate standing	
Hours arranged	Sullivan
LAR 691 Degree Seminar	0
Prerequisites: Three LAR 600 studios	
Hours arranged (52-691-001)	Sullivan
*LAR 698 Advanced Research Projects	2-6
Prerequisite: Two LAR 600 studios or Consent of Instructor	
Hours arranged	Sullivan

*Students may not preregister for this course. Course may be added on Registration Day, May 22.

SECOND SESSION

*LAR 595 Independent Study	1-3
Prerequisite: Graduate standing	
Hours arranged	Sullivan
LAR 691 Degree Seminar	0
Prerequisite: Three LAR 600 studios	
Hours arranged (52-691-001)	Sullivan
*LAR 698 Advanced Research Projects	2-6
Prerequisite: Two LAR 600 studios or Consent of Instructor	
Hours arranged	Sullivan

* Students may not preregister for this course. Course may be added on Registration Day, July 5

Mathematics

FIRST SESSION

MA 102 Analytic Geometry and Calculus I	4
Prerequisite: MA 111 or equivalent completed in high school.	
Credit not allowed for more than one of MA 102, MA 112, MA 113.	
0730-0940 (54-102-001) (54-102-002) (54-102-003)	Staff
1020-1230 (54-102-004) (54-102-005) (54-102-006)	Staff
MA 111 Algebra and Trigonometry	4
Credit is not allowed for both MA 100 and MA 111. For students in Engineering, Physical and Mathematical Sciences, Design, Biological and Agricultural Engineering (Science program), Biological Sciences (all options), and Mathematics Education, Science Education, credit in MA 111 does not count toward graduation.	
0730-0940 (54-111-001) (54-111-002)	Staff
1020-1230 (54-111-003) (54-111-004) (54-111-005)	Staff
MA 112 Analytic Geometry and Calculus A	4
Prerequisite: MA 111 or equivalent completed in high school	
Credit is not allowed for more than one of MA 102, MA 112, MA 113.	
0730-0940 (54-112-001)	Staff
1020-1230 (54-112-002)	Staff
MA 113 Elements of Calculus	4
Prerequisite: MA 111 or equivalent completed in high school	
Credit is not allowed in more than one of MA 102, MA 112, MA 113. MA 113 may not be substituted for MA 102 as a curricular requirement.	
0730-0940 (54-113-001) (54-113-002)	Staff
MA 114 Introduction to Finite Mathematics with Applications	3
Prerequisite: MA 111 or equivalent completed in high school	
0800-0930 (54-114-001) (54-114-002)	Staff
MA 115A Basic Algebra	4
Credit in MA 115 is not allowed if student has prior credit for MA 102, MA 111, MA 112, MA 113, or MA 114. Credit for graduation is not given for MA 115 in any curricula.	
1020-1230 (54-115-001)	Staff
MA 122 Mathematics of Finance	3
Prerequisite: MA 111 or MA 115 or equivalent completed in high school	
0800-0930 (54-122-001) (54-122-002)	Staff

MA 201 Analytic Geometry and Calculus II	4
Prerequisite: MA 102	
0730-0940 (54-201-001) (54-201-002) (54-201-003)	Staff
1020-1230 (54-201-004) (54-201-005) (54-201-006)	Staff
MA 202 Analytic Geometry and Calculus III	4
Prerequisite: MA 201	
0730-0940 (54-202-001) (54-202-002)	Staff
1020-1230 (54-202-003) (54-202-004)	Staff
MA 301 Applied Differential Equations I	3
Prerequisite: MA 202	
0800-0930 (54-301-001) (54-301-002)	Staff
1140-1310 (54-301-003) (54-301-004) (54-301-005)	Staff
MA 405 Introduction to Linear Algebra and Matrices	3
Prerequisite: One year of calculus	
0800-0930 (54-405-001)	Staff
1140-1310 (54-405-002)	Staff
MA 421 Introduction to Probability	3
Prerequisite: One year of calculus	
1140-1310 (54-421-001)	Staff
MA 501 Advanced Mathematics for Engineers and Scientists I	3
Prerequisite: MA 301 or equivalent, credit for this course and MA 401 is not allowed	
1140-1310 (54-501-001) (54-501-002)	Staff
MA 511 Advanced Calculus I	3
Prerequisite: MA 301	
1140-1310 (54-511-001)	Staff
MA 512 Advanced Calculus II	3
Prerequisite: MA 301	
1140-1310 (54-512-001)	Staff
MA 513 Introduction to Complex Variables	3
Prerequisite: MA 202	
0800-0930 (54-513-001)	Staff
MA (ST) 541 Theory of Probability I	3
Prerequisite: MA 425 or MA 511	
0800-0930 (54-541-001)	Staff
MA 699 Research	Credits Arranged
Hours arranged (54-699-001)	Staff
SECOND SESSION	
MA 100 Precalculus Trigonometry	2
Credit not allowed for both MA 100 and MA 111. Credit towards graduation is not given for MA 100 in any curricula.	
0730-0835 (54-100-001) (54-100-002)	Staff
1020-1125 (54-100-003) (54-100-004)	Staff
MA 102 Analytic Geometry and Calculus I	4
Prerequisite: MA 111 or equivalent completed in high school	
Credit not allowed for more than one of MA 102, MA 112, MA 113.	
0730-0940 (54-102-001)	Staff
1020-1230 (54-102-002) (54-102-003)	Staff

MA 111 Algebra and Trigonometry	4
Credit is not allowed for both MA 100 and MA 111. For students in Engineering, Physical and Mathematical Sciences, Design, Biological and Agricultural Engineering (Science program), Biological Sciences (all options) and Mathematics Education, Science Education, credit in MA 111 does not count toward graduation requirements.	
0730-0940 (54-111-001) (54-111-002) (54-111-003)	Staff
1020-1230 (54-111-004) (54-111-005) (54-111-006) (54-111-007)	Staff
MA 112 Analytic Geometry and Calculus A	4
Prerequisite: MA 111 or equivalent completed in high school	
Credit is not allowed in more than one of MA 102, MA 112, MA 113.	
1020-1230 (54-112-001)	Staff
MA 113 Elements of Calculus	4
Prerequisite: MA 111 or equivalent completed in high school	
Credit is not allowed in more than one of MA 102, MA 112, MA 113. MA 113 may not be substituted for MA 102 as a curricular requirement.	
1020-1230 (54-113-001) (54-113-002)	Staff
MA 114 Introduction to Finite Mathematics with Applications	3
Prerequisite: MA 111 or equivalent completed in high school	
0800-0930 (54-114-001) (54-114-002)	Staff
MA 115A Basic Algebra	4
Credit in MA 115 is not allowed if student has prior credit for MA 102, MA 111, MA 112, MA 113, or MA 114. Credit toward graduation is not given for MA 115 in any curricula.	
0730-0940 (54-115-001)	Staff
1020-1230 (54-115-002)	Staff
MA 201 Analytic Geometry and Calculus II	4
Prerequisite: MA 102	
0730-0940 (54-201-001) (54-201-002)	Staff
1020-1230 (54-201-003) (54-201-004)	Staff
MA 202 Analytic Geometry and Calculus III	4
Prerequisite: MA 201	
0730-0940 (54-202-001) (54-202-002)	Staff
1020-1230 (54-202-003) (54-202-004)	Staff
MA 212 Analytic Geometry and Calculus B	3
Prerequisite: MA 112	
1140-1310 (54-212-001)	Staff
MA 301 Applied Differential Equations I	3
Prerequisite: MA 202	
0800-0930 (54-301-001)	Staff
1140-1310 (54-301-002) (54-301-003)	Staff
MA 401 Applied Differential Equations II	3
Prerequisite: MA 301. Credit for MA 401 and MA 501 will not be given.	
0800-0930 (54-401-001)	Staff
MA 405 Introduction to Linear Algebra and Matrices	3
Prerequisite: One year of calculus	
1140-1310 (54-405-001) (54-405-002)	Staff
MA 433 History of Mathematics	3
Prerequisite: One year of calculus	
0950-1120 (54-433-001)	Staff

MA 502 Advanced Mathematics for Engineers and Scientists II	3
Prerequisite: MA 301 or equivalent. Any student receiving credit for MA 502 may receive credit for, at most, one of the following: MA 405, MA 512, or MA 513	
1140-1310 (54-502-001)	Staff
MA 512 Advanced Calculus II	3
Prerequisite: MA 301	
0800-0930 (54-512-001)	Staff
MA 699 Research	Credits Arranged
Hours arranged (54-699-001)	Staff

TEN-WEEK SESSION

MA 111E Algebra and Trigonometry	4
Credit is not allowed for both MA 100 and MA 111. For students in Engineering, Physical and Mathematical Sciences, Design, Biological and Agricultural Engineering (Science program), Biological Sciences (all options), and Mathematics Education, Science Education credit in MA 111 does not count toward graduation.	
1915-2150 MW (54-111-006) (54-111-007)	Staff
MA 113E Elements of Calculus	4
Prerequisite: MA 111 or equivalent completed in high school	
Credit is not allowed in more than one of MA 102, MA 112, MA 113. MA 113 may not be substituted for MA 102 as a curricular requirement.	
1915-2150 TuTh (54-113-003)	Staff
MA 114E Introduction to Finite Mathematics with Applications	3
Prerequisite: MA 111 or equivalent completed in high school	
1945-2145 MW (54-114-003)	Staff

Mechanical and Aerospace Engineering

FIRST SESSION

MAE 206 Engineering Statics	3
Prerequisite: PY 205	
Corequisite: MA 202	
0800-0930 (55-206-001)	Staff
0800-0930 (55-206-002)	Staff
0950-1120 (55-206-003)	Staff
MAE 208 Engineering Dynamics	3
Prerequisite: MAE 206	
Corequisite: MA 301	
0800-0930 (55-208-001)	Staff
0950-1120 (55-208-002)	Staff
MAE 301 Engineering Thermodynamics I	3
Prerequisites: MA 202, PY 208 or PY 202	
0800-0930 (55-301-001)	Staff
0950-1120 (55-301-002)	Hodgson
1140-1310 (55-301-003)	Mulligan
MAE 305 Mechanical Engineering Laboratory I	1
Corequisite: MAE 301	
1340-1750 TuTh (55-305-001)	Batton
1340-1750 MW (55-305-002)	Staff
1750-2200 MW (55-305-003)	Staff
1750-2200 TuTh (55-305-004)	Staff

MAE 308 Fluid Mechanics I	3
Prerequisites: MAE 206 or CE 213, MA 202	
0800-0930 (55-308-001)	Edwards
1140-1310 (55-308-002)	Hodgson
1140-1310 (55-308-003)	Staff
MAE 310 Conduction and Radiation Heat Transfer	3
Prerequisites: MA 301 and a grade of C or better in MAE 301	
0950-1120 (55-310-001)	Edwards
0950-1120 (55-310-002)	Staff
1140-1310 (55-310-003)	Staff
MAE 314 Solid Mechanics	3
Prerequisites: MAE 206, CE 213 or CE 214	
Corequisite: MAT 201	
0800-0930 (55-314-001)	Staff
0950-1120 (55-314-002)	Staff
0950-1120 (55-314-003)	Staff
MAE 586 Project Work in Mechanical Engineering	1-6
Hours arranged (55-586-001)	Staff
MAE 699 Mechanical Engineering Research	Credits Arranged
Prerequisites: Graduate standing in Mechanical Engineering and Consent of Advisor	
Hours arranged (55-699-001)	Staff
SECOND SESSION	
MAE 206 Engineering Statics	3
Prerequisite: PY 205	
Corequisite: MA 202	
0800-0930 (55-206-001)	Staff
MAE 208 Engineering Dynamics	3
Prerequisite: MAE 206	
Corequisite: MA 301	
0950-1120 (55-208-001)	Staff
0950-1120 (55-208-002)	Staff
MAE 261 Aerospace Vehicle Performance	3
Prerequisites: MA 201, PY 205	
1140-1310 (55-261-001)	Perkins
MAE 301 Engineering Thermodynamics I	3
Prerequisites: MA 202, PY 208 or PY 202	
0800-0930 (55-301-001)	Afify
0800-0930 (55-301-002)	Staff
0950-1120 (55-301-003)	Boles
1140-1310 (55-301-004)	Boles
MAE 302 Engineering Thermodynamics II	3
Prerequisite: A grade of C or better in MAE 301	
0800-0930 (55-302-001)	Perkins
0950-1120 (55-302-002)	Johnson
0950-1120 (55-302-003)	Staff
MAE 306 Mechanical Engineering Laboratory II	1
Prerequisites: MAE 305, ECE 331	
1340-1750 TuTh (55-306-001)	Batton
1340-1750 MW (55-306-002)	Staff
1750-2200 MW (55-306-003)	Staff
1750-2200 TuTh (55-306-004)	Staff

MAE 410 Convective Heat Transfer and Fluid Flow	3
1140-1310 (55-410-001)	Johnson
1140-1310 (55-410-002)	Staff
MAE 411 Machine Component Design	3
Prerequisites: MAE 315, MAE 316	
0800-0930 (55-411-001)	Maday
MAE 435 Principles of Automatic Control	3
Prerequisite: MA 301	
0800-0930 (55-435-001)	Hale
1140-1310 (55-435-002)	Staff
MAE 462 Flight Vehicle Stability and Control	3
Prerequisites: MAE 261, MAE 435	
0950-1120 (55-462-001)	Hale
MAE 586 Project Work in Mechanical Engineering	1-6
Hours arranged (55-586-001)	Staff
MAE 699 Mechanical Engineering Research	Credits Arranged
Prerequisites: Graduate standing in Mechanical Engineering and Consent of Advisor	
Hours arranged (55-699-001)	Staff
TEN-WEEK SESSION	
MAE 206 Engineering Statics	3
Prerequisite: PY 205	
Corequisite: MA 202	
0800-0915 MWF (55-206-001)	Staff
MAE 208 Engineering Dynamics	3
Prerequisite: MAE 206	
Corequisite: MA 301	
0800-0915 MWF (55-208-001)	Staff
MAE 301 Engineering Thermodynamics I	3
Prerequisites: MA 202, PY 208 or PY 202	
0800-0915 MWF (55-301-001)	Staff
1000-1115 MWF (55-301-002)	Staff
MAE 308 Fluid Mechanics	3
Prerequisites: MAE 206 or CE 213, MA 202	
1145-1300 MWF (55-308-001)	Staff
MAE 315 Dynamics of Machines	3
Prerequisites: MAE 216 and a grade of C or better in MAE 208	
0800-0915 MWF (55-315-001)	Strenkowski
1000-1115 MWF (55-315-002)	Staff
MAE 316 Strength of Mechanical Components	3
Prerequisite: MAE 314	
1000-1115 MWF (55-316-001)	Staff
1145-1300 MWF (55-316-002)	Staff
MAE 586 Project Work in Mechanical Engineering	1-6
Hours arranged (55-586-001)	Staff
MAE 699 Mechanical Engineering Research	Credits Arranged
Prerequisites: Graduate standing in Mechanical Engineering and Consent of Advisor	
Hours arranged (55-699-001)	Staff

Materials Engineering

FIRST SESSION

MAT 200 Mechanical Properties of Structural Materials	2
Prerequisites: CH 105 and the first course in ESM	
LR 1020-1120 MWF (61-200-001)	Fahmy
LB 1340-1650 MWF (61-200-101) (61-200-102)	
MAT 201 Structure and Properties of Engineering Materials	3
Prerequisite: CH 105	
LR 1200-1330 (61-201-001)	Fahmy
PR 1340-1620 TuTh (61-201-201) (61-201-202)	
MAT 495 Materials Engineering Projects	1-6
Prerequisite: Junior or Senior standing	
Hours arranged (61-495-001)	Staff
MAT 595 Advanced Materials Experiments	1-3
Prerequisite: Senior or Graduate standing	
Hours arranged (61-595-001)	Staff
MAT 699 Materials Engineering Research	Credits Arranged
Hours arranged (61-699-001)	Staff

SECOND SESSION

MAT 201 Structure and Properties of Engineering Materials	3
Prerequisite: CH 105	
LR 1200-1330 (61-201-001)	Staff
PR 1340-1620 TuTh (61-201-201) (61-201-202)	
MAT 495 Materials Engineering Projects	1-6
Prerequisite: Junior or Senior standing	
Hours arranged (61-495-001)	Staff
MAT 595 Advanced Materials Experiments	1-3
Prerequisite: Senior or Graduate standing	
Hours arranged (61-595-001)	Staff
MAT 699 Materials Engineering Research	Credits Arranged
Hours arranged (61-699-001)	Staff

Microbiology

FIRST SESSION

MB 490 Special Studies in Microbiology	Credits Arranged
Prerequisites: Three courses in microbiology and permission of instructor	
Hours arranged (57-490-001)	Staff
MB 692 Special Problems in Microbiology	Credits Arranged
Hours arranged (57-692-001)	Staff
MB 699 Microbiology Research	Credits Arranged
Hours arranged (57-699-001)	Staff

SECOND SESSION

MB 490 Special Studies in Microbiology	Credits Arranged
Prerequisites: Three courses in microbiology and permission of instructor	
Hours arranged (57-490-001)	Staff

MB 692 Special Problems in Microbiology
Hours arranged (57-692-001)

Credits Arranged
Staff

MB 699 Microbiology Research
Hours arranged (57-699-001)

Credits Arranged
Staff

Marine, Earth and Atmospheric Sciences

EARTH SCIENCE

FIRST SESSION

MEA 101 General Physical Geology
0800-0930 (53-101-001)

3
Brown

MEA 110 Physical Geology Laboratory
Corequisite: MEA 101 or MEA 120
1020-1230 MW (53-110-001)
1340-1550 TuTh (53-110-002)

1
Staff
Staff

MEA 465 Geologic Field Camp I

3

Prerequisites: MEA 351, MEA 440, MEA 452

First part of six weeks out-of-state summer field camp. Both MEA 465 and MEA 466 must be taken in the same summer.

Hours arranged (53-465-001)

Kimberley/Nitttrouer

Hours arranged (53-465-002)

Kimberley/Nitttrouer

MEA 593G Special Topics

1-6

Prerequisite: Consent of Instructor

Hours arranged (53-593-001)

Staff

MEA 598 Advanced Topics in Geophysics

1-6

Prerequisite: Consent of Instructor

Hours arranged (53-598-001)

Staff

MEA 698 Geophysical Research

Credits Arranged

Prerequisite: Consent of Instructor

Hours arranged (53-698-001)

Staff

MEA 699G Research

Credits Arranged

Prerequisite: Consent of Instructor

Hours arranged (53-699-001)

Staff

SECOND SESSION

MEA 202 Historical Geology

3

Prerequisite: MEA 101 or MEA 120

0950-1120 (53-202-001)

Staff

MEA 210 Historical Geology Laboratory

1

Corequisite: MEA 202

1340-1550 TuTh (53-210-001)

Staff

MEA 466 Geologic Field Camp II

3

Prerequisite: MEA 465

Second part of six weeks out-of-state summer field camp. Both MEA 465 and MEA 466 must be taken in the same summer.

Hours arranged (53-466-001)

Kimberley/Abbott

Hours arranged (53-466-002)

Kimberley/Abbott

MEA 593G Special Topics

1-6

Prerequisite: Consent of Instructor

Hours arranged (53-593-001)

Staff

MEA 598 Advanced Topics in Geophysics	1-6
Prerequisite: Consent of Instructor	
Hours arranged (53-598-001)	Staff
MEA 698 Geophysical Research	Credits Arranged
Prerequisite: Consent of Instructor	
Hours arranged (53-698-001)	Staff
MEA 699G Research	Credits Arranged
Prerequisite: Consent of Instructor	
Hours arranged (53-699-001)	Staff

Marine Science

FIRST SESSION

MEA 693 Advanced Special Topics	1-3
Prerequisites: Graduate standing and consent of staff	
Hours arranged (53-693-001)	Staff
MEA 699S Research	Credits Arranged
Prerequisites: Graduate standing and consent of advisory committee	
Hours arranged (53-699-002)	Staff

SECOND SESSION

MEA 693 Advanced Special Topics	1-3
Prerequisites: Graduate standing and consent of staff	
Hours arranged (53-693-001)	Staff
MEA 699S Research	Credits Arranged
Prerequisites: Graduate standing and consent of advisory committee	
Hours arranged (53-699-002)	Staff

Atmospheric Science

FIRST SESSION

MEA 593M Special Topics	1-6
Prerequisite: Consent of staff	
Hours arranged (53-593-002)	Staff
MEA 695M Seminar	1
Prerequisite: Graduate standing	
Hours arranged (53-695-001)	Staff
MEA 699M Research	Credits Arranged
Prerequisites: Graduate standing and consent of advisory committee	
Hours arranged (53-699-003)	Staff

SECOND SESSION

MEA 493A Special Topics in Meteorology	3
Prerequisite: Consent of staff	
0800-1040 (53-493-001)	Staff
MEA 493B Special Topics in Meteorology	3
Prerequisite: Consent of staff	
1100-1340 (53-493-002)	Staff
MEA 593M Special Topics	1-6
Prerequisite: Consent of staff	
Hours arranged (53-593-002)	Staff

MEA 695M Seminar	1
Prerequisite: Graduate standing Hours arranged (53-695-001)	Staff
MEA 699M Research	Credits Arranged
Prerequisites: Graduate standing and consent of advisory committee	
Hours arranged (53-699-003)	Staff

Military Science (Army ROTC)

FIRST SESSION

MS 101 Introduction to ROTC and the Army	1
0950-1120 MW (58-101-001)	Staff

SECOND SESSION

MS 106 Map Reading	1
0950-1120 MW (58-106-001)	Staff

THE COURSES LISTED ABOVE ARE OPEN TO ANY INTERESTED STUDENT.

Music

FIRST SESSION

MUS 200 Understanding Music	3
0800-0930 (69-200-001)	Hammond
0800-0930 (69-200-002)	Bliss
0950-1120 (69-200-003)	Hammond

MUS 320 Music of the 20th Century	3
0950-1120 (69-320-001)	Bliss

SECOND SESSION

MUS 200 Understanding Music	3
0800-0930 (69-200-001)	Petters
0800-0930 (69-200-002)	Ward
0950-1120 (69-200-003)	Petters
0950-1120 (69-200-004)	Ward

Nuclear Engineering

FIRST SESSION

NE 491 Special Topics in Nuclear Engineering	1-4
Prerequisite: Consent of Instructor	
Hours arranged (70-491-001)	Staff

NE 691 Advanced Topics in Nuclear Engineering I	3
Prerequisite: Consent of Instructor Hours arranged (70-691-001)	Staff

NE 699 Research in Nuclear Engineering	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (70-699-001)	Staff

SECOND SESSION

NE 201 Applications of Nuclear Energy	3
Prerequisite: PY 208	
0950-1120 (70-201-001)	Stam

NE 491 Special Topics in Nuclear Engineering	1-4
Prerequisite: Consent of Instructor	
Hours arranged (70-491-001)	Staff
NE 691 Advanced Topics in Nuclear Engineering I	3
Prerequisite: Consent of Instructor	
Hours arranged (70-691-001)	Staff
NE 699 Research in Nuclear Engineering	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (70-699-001)	Staff

Nutrition

FIRST SESSION

NTR 699 Research in Nutrition	Credits Arranged
Hours arranged (71-699-001)	Staff

SECOND SESSION

NTR 699 Research in Nutrition	Credits Arranged
Hours arranged (71-699-001)	Staff

Operations Research

FIRST SESSION

OR 591 Special Topics in Operations Research	1-3
Prerequisite: Consent of Instructor	
Hours arranged (73-591-001)	Staff

OR 691 Special Topics in Operations Research	3
Prerequisites: OR 501, OR 505, (IE 505, MA 505)	
Hours arranged (73-691-001)	Staff

OR 699 Project in Operations Research	1-3
Hours arranged (73-699-001)	Staff

SECOND SESSION

OR 591 Special Topics in Operations Research	1-3
Prerequisite: Consent of Instructor	
Hours arranged (73-591-001)	Staff

OR 691 Special Topics in Operations Research	3
Prerequisites: OR 501, OR 505 (IE 505, MA 505)	
Hours arranged (73-691-001)	Staff

OR 699 Project in Operations Research	1-3
Hours arranged (73-699-001)	Staff

Political Science & Public Administration

PUBLIC ADMINISTRATION

FIRST SESSION

*PA 516E Public Policy Analysis	3
Prerequisite: Advanced undergraduate standing, including 12 hours of political science or graduate standing or Post-Baccalaureate Studies status	
1900-2200 MW (34-516-001)	Swiss

****PA 614E Seminar in Management Systems** 3
 Prerequisites: Graduate standing or Management Development Certificate Program and six semester hours of 500-level coursework
 1900-2200 TuTh (34-614-001) Swiss

PA 691 Internship in Public Affairs 1-3
 Prerequisite: Minimum 9 hours of graduate work
 Hours arranged (34-691-001) O'Sullivan

* There will be additional classes on June 16 and June 27. The final examination will be on July 2.

**There will be additional classes on June 16 and June 28. The final examination will be on July 2.

SECOND SESSION

PA 511 Public Administration 3
 Prerequisite: Advanced undergraduate standing, including 12 hours of political science; graduate standing or Post-Baccalaureate Studies status
 0800-0930 (34-511-001) McClain

PA 513E Financial Management in the Public Sector 3
 Prerequisites: ACC 265 and graduate standing or PBS status
 1630-1830 MTuWTh (34-513-001) Coe

PA 598 Special Topics in Public Administration: SAS 3
Computer Applications
 Prerequisite: Advanced undergraduate standing, including 12 hours of political science; graduate standing or Post-Baccalaureate Studies status
 1140-1310 (34-598-001) Edgmon

PA 612 The Budgetary Process 3
 Prerequisites: Graduate standing or Management Development Certificate Program and six semester hours of 500-level coursework
 0800-0930 (34-612-001) Coe

POLITICAL SCIENCE

FIRST SESSION

PS 201 Introduction to American Government 3
 0800-0930 (80-201-001) Pavlik
 0950-1120 (80-201-002) Pavlik

PS 206 Local Government Systems 3
 1140-1310 (80-206-001) Edgmon

PS 306 Law and the Courts in the American Political System 3
 0950-1120 (80-306-001) Reid

PS 498 Special Topics in Political Science: U.S.—Latin 3
American Relations
 0800-0930 (80-498-001) Staff

PS 490 Readings and Research in Political Science 1-6
 Prerequisite: Consent of the department
 Hours arranged (80-490-001) Staff

PS 491 Internship in Political Science 1-6
 Prerequisite: Consent of department
 Hours arranged (80-491-001) Staff

PS 492 Honors Readings and Thesis in Political Science	3-6
Prerequisites: Admission to Honors Program and Consent of Instructor	
Hours arranged (80-492-001)	Staff
PS 699 Research in Politics	Credits Arranged
Prerequisites: Graduate standing and approval of advisor	
Hours arranged (80-699-001)	Staff
SECOND SESSION	
PS 201 Introduction to American Government	3
0800-0930 (80-201-001)	Staff
0950-1120 (80-201-002)	Holtzman
PS 206 Local Governmental Systems	3
0950-1120 (80-206-001)	McClain
PS 401 American Parties and Pressure Groups	3
0800-0930 (80-401-001)	Holtzman
PS 490 Readings and Research in Political Science	1-6
Prerequisite: Consent of the department	
Hours arranged (80-490-001)	Staff
PS 491 Internship in Political Science	1-6
Prerequisite: Consent of the department	
Hours arranged (80-491-001)	Staff
PS 492 Honors Readings and Thesis in Political Science	3-6
Prerequisites: Admission to Honors Program and Consent of Instructor	
Hours arranged (80-492-001)	Staff
PS 699 Research in Politics	Credits Arranged
Prerequisites: Graduate standing and approval of advisor	
Hours arranged (80-699-001)	Staff

Product Design

FIRST SESSION	
*PD 595 Independent Study	1-3
Prerequisite: Graduate standing	
Hours arranged	Foote
PD 690 Special Topics in Product Design	1-6
Prerequisite: Graduate standing	
Hours arranged (82-690-001)	Foote
PVD 400 Intermediate Visual Design	6
Prerequisite: DF 102	
0750-1300 (42-400-001)	Prygrocki

* Students may not preregister for this course. Course may be added on Registration Day, May 22.

SECOND SESSION

*PD 595 Independent Study	1-3
Prerequisite: Graduate standing	
Hours arranged	Foote

* Students may not preregister for this course. Course may be added on Registration Day, July 5.

PD 691 Special Topics in Product Design

1-6

Prerequisite: Graduate standing

Hours arranged (82-691-001)

Foote

Physical Education**FIRST SESSION****PE 112 Beginning Swimming I**

1

1020-1120 (75-112-001)

Retzlaff

1300-1400 (75-112-002)

Shea

PE 112E Beginning Swimming I

1

1945-2045 MTuWTh (75-112-003)

Daniels

PE 221 Intermediate Swimming

1

1300-1400 (75-221-001)

Berle

1400-1500 (75-221-002)

Shea

PE 225 Skin Diving

1

1020-1120 (75-225-001)

L. Brown

PE 226 SCUBA Diving

1

Prerequisite: PE 225 or equivalent

1400-1500 (75-226-001)

L. Brown

PE 231 Body Mechanics

1

0910-1010 (75-231-001)

Retzlaff

1300-1400 (75-231-002)

Retzlaff

PE 237 Weight Training

1

1200-1300 (75-237-001)

Rhodes

PE 240M Social Dance (Men Only)

1

0930-1030 (75-240-001)

Berle

PE 240W Social Dance (Women Only)

1

0930-1030 (75-240-101)

Berle

PE 242 Badminton

1

1020-1120 (75-242-001)

Shannon

1200-1300 (75-242-002)

Retzlaff

PE 243 Bowling

1

\$35.00 Bowling Alley Fee

1200-1300 (75-243-001)

Evans

PE 245 Golf

1

0910-1010 (75-245-001)

Gwyn

1020-1120 (75-245-002)

Gwyn

1300-1400 (75-245-003)

Gwyn

1400-1500 (75-245-004)

Gwyn

PE 249 Tennis I

1

0910-1010 (75-249-001)

Shea

1020-1120 (75-249-002)

Evans

1200-1300 (75-249-003)

Shea

1300-1400 (75-249-004)

Rhodes

1400-1500 (75-249-005)

Berle

PE 251 Target Archery

1

0910-1010 (75-251-001)

L. Brown

PE 251E Target Archery	1
1745-1845 MTuWTh (75-251-002)	Daniels
PE 256 Racquetball	1
0910-1010 (75-256-001)	Evans
1300-1400 (75-256-002)	L. Brown
1400-1500 (75-256-003)	Evans
PE 265 Softball	1
0910-1010 (75-265-001)	Rhodes
1020-1120 (75-265-002)	Rhodes
PE 269 Volleyball	1
1200-1300 (75-269-001)	Berle
PE 280 Emergency Medical Care and First Aid	2
This course does not constitute credit toward meeting physical education requirements.	
1500-1615 MTuWTh (75-280-001)	Daniels
SECOND SESSION	
PE 112 Beginning Swimming I	1
1300-1400 (75-112-001)	R. Smith
1400-1500 (75-112-002)	R. Smith
PE 221 Intermediate Swimming	1
1020-1120 (75-221-001)	Moore
PE 221E Intermediate Swimming	1
1945-2045 MTuWTh (75-221-002)	Moore
PE 231 Body Mechanics	1
0910-1010 (75-231-001)	Moore
PE 231E Body Mechanics	1
1745-1845 MTuWTh (75-231-002)	Moore
PE 242 Badminton	1
1020-1120 (75-242-001)	Brothers
1200-1300 (75-242-002)	Cooper
PE 243 Bowling	1
\$35.00 Bowling Alley Fee	
1400-1500 (75-243-001)	Cooper
PE 245 Golf	1
0910-1010 (75-245-001)	Cooper
1020-1120 (75-245-002)	Cooper
1300-1400 (75-245-003)	Brothers
1400-1500 (75-245-004)	Brothers
PE 249 Tennis I	1
0910-1010 (75-249-001)	Cheek
1020-1120 (75-249-002)	Cheek
1300-1400 (75-249-003)	DeWitt
1400-1500 (75-249-004)	DeWitt
PE 251 Target Archery	1
0930-1030 (75-251-001)	R. Smith
1200-1300 (75-251-002)	R. Smith
PE 256 Racquetball	1
0910-1010 (75-256-001)	DeWitt
1020-1120 (75-256-002)	DeWitt

PE 265 Softball	1
1300-1400 (75-265-001)	Cheek
PE 269 Volleyball	1
1200-1300 (75-269-001)	Cheek

Philosophy

(Also see Religion, page 91.)

FIRST SESSION

PHI 201 Logic	3
0800-0930 (74-201-001)	Levin
0950-1120 (74-201-002)	Levin
PHI 205 Problems and Types of Philosophy	3
0800-0930 (74-205-001)	Bredenberg
0950-1120 (74-205-002)	Carter
PHI 306 Philosophy of Art	3
0950-1120 (74-306-001)	Bredenberg
PHI 321 Contemporary Moral Issues	3
0800-0930 (74-321-001)	Carter

SECOND SESSION

PHI 201 Logic	3
0800-0930 (74-201-001)	Metzger
0950-1120 (74-201-002)	Metzger
PHI 205 Problems and Types of Philosophy	3
0800-0930 (74-205-001)	Austin
0950-1120 (74-205-002)	Austin
1140-1310 (74-205-003)	VanDeVeer
PHI 305 Philosophy of Religion	3
0950-1120 (74-305-001)	Hambourger
PHI 311 Philosophical Issues in Medical Ethics	3
0950-1120 (74-311-001)	VanDeVeer
PHI 321 Contemporary Moral Issues	3
0800-0930 (74-321-001)	Hambourger

Physiology

FIRST SESSION

PHY 590 Special Problems in Physiology	3
Prerequisites: Graduate standing, Consent of Instructor	
Hours arranged (78-590-001)	Thaxton
PHY 699 Physiological Research	Credits Arranged
Prerequisites: Graduate standing, Consent of Instructor	
Hours arranged (78-699-001)	Thaxton

SECOND SESSION

PHY 699 Physiological Research	Credits Arranged
Prerequisites: Graduate standing, Consent of Instructor	
Hours arranged (78-699-001)	Thaxton

Poultry Science

FIRST SESSION

PO 495 Special Problems in Poultry Science	1-6
Prerequisites: Junior standing and Consent of Instructor	
Hours arranged (81-495-001)	Ort
PO 698 Special Problems in Poultry Science	1-6
Prerequisite: Graduate standing	
Hours arranged (81-698-001)	Ort
PO 699 Poultry Research	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (81-699-001)	Ort

SECOND SESSION

PO 495 Special Problems in Poultry Science	1-6
Prerequisites: Junior standing and Consent of Instructor	
Hours arranged (81-495-001)	Ort
PO 698 Special Problems in Poultry Science	1-6
Prerequisite: Graduate standing	
Hours arranged (81-698-001)	Ort
PO 699 Poultry Research	Credits Arranged
Prerequisite: Graduate standing	
Hours arranged (81-699-001)	Ort

Plant Pathology

FIRST SESSION

PP 595 Special Problems in Plant Pathology	Credits Arranged
Prerequisite: Consent of Instructor	Maximum 6
Hours arranged (79-595-001)	Grand
PP 699 Research in Plant Pathology	Credits Arranged
Prerequisites: Graduate standing and Consent of Instructor	
Hours arranged (79-699-001)	Grand

SECOND SESSION

PP 595 Special Problems in Plant Pathology	Credits Arranged
Prerequisite: Consent of Instructor	Maximum 6
Hours arranged (79-595-001)	Grand
PP 699 Research in Plant Pathology	Credits Arranged
Prerequisites: Graduate standing and Consent of Instructor	
Hours arranged (79-699-001)	Grand

TEN-WEEK SESSION

PP 503 Plant Disease Diagnoses	4
Prerequisite: PP 501 and PP 502A, B, C or equivalent	
LB 0800-1800 MF (79-503-001)	Grand/Jones/Milholland

Psychology

FIRST SESSION

PSY 200 Introduction to Psychology	3
0800-0930 (83-200-001)	Gray
0950-1120 (83-200-002)	Staff
0950-1120 (83-200-003)	Cunningham
1140-1310 (83-200-004)	Cunningham
PSY 210 Psychological Analysis Applied to Current Problems	3
Prerequisite: PSY 200	
0800-0930 (83-210-001)	Smith
PSY 300 Perception	3
Prerequisite: PSY 200; Introductory BS, CH or PY recommended	
0950-1120 (83-300-001)	Mershon
PSY 304 Educational Psychology	3
0950-1120 (83-304-001)	Staff
PSY 475 Child Psychology	3
Prerequisite: PSY 200 or PSY 304	
1330-1500 (83-475-001)	Walker
PSY 476 Psychology of Adolescent Development	3
Prerequisite: Junior standing	
0800-0930 (83-476-001)	Snyder
PSY 491B Special Topics in Psychology: Sports Psychology	3
Prerequisite: PSY 200	
0950-1120 (83-491-001)	Walker
PSY 499 Individual Study in Psychology	1-6
Prerequisite: Consent of Department	
Hours arranged (83-499-001)	Staff
PSY 504E Advanced Educational Psychology	3
Prerequisite: Six hours of PSY	
1600-1930 MW (83-504-001)	Makoid
1600-1930 TuTh (83-504-002)	Makoid
PSY 599 Research Problems in Psychology	Credits Arranged
Prerequisite: Consent of Instructor	
Hours arranged (83-599-001)	Staff
PSY 693 Psychological Clinic Practicum	1-12
Prerequisite: Twelve hours in graduate Psychology, which must include clinical skill courses	
PSY 571 and PSY 672 and/or Consent of Instructor	
Hours arranged (83-693-001)	Staff
PSY 699 Thesis and Dissertation Research	Credits Arranged
Prerequisites: Graduate standing and Consent of Instructor	
Hours arranged (83-699-001)	Staff

SECOND SESSION

PSY 200 Introduction to Psychology	3
0800-0930 (83-200-001)	Pond
0950-1120 (83-200-002)	Pond
1140-1310 (83-200-003)	Staff
PSY 304 Educational Psychology	3
0950-1120 (83-304-001)	Staff

PSY 330 Biological Psychology	3
Prerequisite: PSY 200	
0800-0930 (83-330-001)	Kalat
PSY 370 Personality, Psychopathology and Therapy	3
Prerequisite: PSY 200	
0950-1120 (83-370-001)	Horan
PSY 476 Psychology of Adolescent Development	3
Prerequisite: Junior standing	
0800-0930 (83-476-001)	Snyder
PSY 499 Individual Study in Psychology	1-6
Prerequisite: Consent of Department	
Hours arranged (83-499-001)	Staff
PSY 535 Tests and Measurement	3
Prerequisite: Six hours of Psychology	
0800-0930 (83-535-001)	Westbrook
0950-1120 (83-535-002)	Westbrook
PSY 599 Research Problems in Psychology	Credits Arranged
Prerequisite: Consent of Instructor	
Hours arranged (83-599-001)	Staff
PSY 693 Psychological Clinic Practicum	1-12
Prerequisite: Twelve hours in graduate Psychology, which must include clinical skill courses	
PSY 571 and PSY 672 and/or Consent of Instructor	
Hours arranged (83-693-001)	Staff
PSY 699 Thesis and Dissertation Research	Credits Arranged
Prerequisites: Graduate standing and Consent of Instructor	
Hours arranged (83-699-001)	Staff

Physics

FIRST SESSION

PY 205 General Physics	4
Prerequisite: MA 102	
LR 0800-0930 (77-205-001)	Staff
LR 0950-1120 (77-205-002)	Staff
LR 1340-1510 (77-205-003)	Staff
LB 0730-0940 MW (77-205-101)	
LB 0730-0940 TuTh (77-205-102)	
LB 1020-1230 MW (77-205-103)	
LB 1020-1230 TuTh (77-205-104)	
LB 1250-1500 MW (77-205-105)	
LB 1250-1500 TuTh (77-205-106)	
LB 1520-1730 MW (77-205-107)	
PY 208 General Physics	4
Prerequisite: PY 205	
LR 0800-0930 (77-208-001)	Staff
LR 0950-1120 (77-208-002)	Staff
LB 1020-1230 MW (77-208-101)	
LB 1020-1230 TuTh (77-208-102)	
LB 1250-1500 MW (77-208-103)	
LB 1250-1500 TuTh (77-208-104)	
LB 1520-1730 MW (77-208-105)	
LB 1520-1730 TuTh (77-208-106)	

PY 211 General Physics	4
Prerequisite: MA 111 or MA 116	
LR 0800-0930 (77-211-001)	Staff
LB 1250-1500 MW (77-211-101)	
LB 1250-1500 TuTh (77-211-102)	
PY 212 General Physics	4
Prerequisite: PY 211	
LR 0950-1120 (77-212-001)	Staff
LB 1250-1500 MW (77-212-101)	
LB 1250-1500 TuTh (77-212-102)	
PY 221 College Physics	5
Prerequisite: MA 111 or MA 115	
1020-1300 (77-221-001)	Staff
PY 231 Physics for Nonscientists	4
LR 0950-1120 (77-231-001)	Owen
LB 1250-1500 MW (77-231-101)	
PY 407 Introduction to Modern Physics	3
Prerequisites: MA 202, PY 208	
0800-0930 (77-407-001)	Staff
PY 499 Special Problems in Physics	1-3
Prerequisite: Consent of department	
Hours arranged (77-499-001)	Staff
PY 590 Special Topics in Physics	3
Prerequisite: Consent of department	
Hours arranged (77-590-001)	Staff
PY 699 Research	Credits Arranged
Hours arranged (77-699-001)	Staff
SECOND SESSION	
PY 205 General Physics	4
Prerequisite: MA 102	
LR 0800-0930 (77-205-001)	Staff
LR 0950-1120 (77-205-002)	Staff
LR 1340-1510 (77-205-003)	Staff
LB 0730-0940 MW (77-205-101)	
LB 1020-1230 MW (77-205-102)	
LB 1020-1230 TuTh (77-205-103)	
LB 1250-1500 MW (77-205-104)	
LB 1250-1500 TuTh (77-205-105)	
LB 1520-1730 MW (77-205-106)	
PY 208 General Physics	4
Prerequisite: PY 205	
LR 0800-0930 (78-208-001)	Staff
LR 0950-1120 (77-208-002)	Staff
LR 1340-1510 (77-208-003)	Staff
LB 0730-0940 MW (77-208-101)	
LB 1020-1230 MW (77-208-102)	
LB 1020-1230 TuTh (77-208-103)	
LB 1250-1500 MW (77-208-104)	
LB 1250-1500 TuTh (77-208-105)	
LB 1520-1730 MW (77-208-106)	

PY 211 General Physics	4
Prerequisite: MA 111 or MA 116	
LR 0950-1120 (77-211-001)	Staff
LB 1250-1500 MW (77-211-101)	
PY 212 General Physics	4
Prerequisite: PY 211	
LR 0800-0930 (77-212-001)	Staff
LB 1250-1500 MW (77-212-101)	
LB 1250-1500 TuTh (77-212-102)	
PY 221 College Physics	5
Prerequisite: MA 111 or MA 115	
1020-1300 (77-221-001)	Staff
PY 499 Special Problems in Physics	1-3
Prerequisite: Consent of department	
Hours arranged (77-499-001)	Staff
PY 590 Special Topics in Physics	3
Prerequisite: Consent of department	
Hours arranged (77-590-001)	Staff
PY 699 Research	Credits Arranged
Hours arranged (77-699-001)	Staff

Religion

(Also see Philosophy, page 86.)

FIRST SESSION

REL 300 Introduction to Religion	3
0800-0930 (87-300-001)	Highfill
0950-1120 (87-300-002)	Highfill
REL 312 Introduction to the New Testament	3
0800-0930 (87-312-001)	VanderKam
0950-1120 (87-312-002)	VanderKam

SECOND SESSION

REL 300 Introduction to Religion	3
0800-0930 (87-300-001)	Moorhead
0950-1120 (87-300-002)	Moorhead

Recreation Resources Administration

FIRST SESSION

RRA 152 Introduction to Recreation	3
0800-0930 (85-152-001)	Sternloff
0950-1120 (85-152-002)	Staff
RRA 475 Recreation and Park Internship	9
Prerequisites: Senior standing, RRA 359	
Hours arranged (85-475-001)	Kirsch
Hours arranged (85-475-002)	Wilson
RRA 538 Recreation for Special Populations	3
1745-1930 MTuWTh (85-538-001)	Sternloff

*RRA 591 Recreation Resources Problems	1-4
Prerequisite: Advanced undergraduate or Graduate standing	
Hours arranged (85-591-001)	Staff
RRA 692 Advanced Problems in Recreation	Credits Arranged
Prerequisite: Twelve hours RRA courses	
Hours arranged (85-692-001)	Staff
RRA 699 Research in Recreation	Credits Arranged
Prerequisite: Twelve hours RRA courses	
Hours arranged (85-699-001)	Staff
*Not a regular course offering; students must secure an agreement from an individual faculty member to supervise their work.	

SECOND SESSION

RRA 152 Introduction to Recreation	3
0800-0930 (85-152-001)	Love
0950-1120 (85-152-002)	Love
*RRA 591 Recreation Resources Problems	1-4
Prerequisite: Advanced undergraduate or Graduate standing	
Hours arranged (85-591-001)	Staff
RRA 692 Advanced Problems in Recreation	Credits Arranged
Prerequisite: Twelve hours RRA courses	
Hours arranged (85-692-001)	Staff
RRA 699 Research in Recreation	Credits Arranged
Prerequisite: Twelve hours RRA courses	
Hours arranged (85-699-001)	Staff
* Not a regular course offering; students must secure an agreement from an individual faculty member to supervise their work.	

Sociology

FIRST SESSION

SOC 202 Principles of Sociology	3
0800-0930 (92-202-001)	Dawson
0950-1120 (92-202-002)	Howell
0950-1120 (92-202-003)	Staff
1140-1310 (92-202-004)	Dawson
SOC 202E Principles of Sociology	3
1745-1930 MTuWTh (92-202-005)	Staff
SOC 203 Current Social Problems	3
0950-1120 (92-203-001)	Zingraff
SOC 204 Sociology of Family	3
0800-0930 (92-204-001)	Staff
0950-1120 (92-204-002)	Thomson
0950-1120 (92-204-003)	Uzzell
1140-1310 (92-204-004)	Uzzell
SOC 204E Sociology of Family	3
1945-2130 MTuWTh (92-204-005)	Staff

SOC 301 Human Behavior	3
Prerequisite: SOC 202 or PSY 200	
0800-0930 (92-301-001)	Hill
0950-1120 (92-301-002)	Brisson
SOC 305 Race and Ethnic Relations	3
Prerequisite: Three credits in SOC	
0800-0930 (92-305-001)	Della Fave
SOC 306 Criminology	3
Prerequisite: Three credits in SOC	
0800-0930 (92-306-001)	Zingraff
SOC 311 Community Relationships	3
Prerequisite: Three credits in SOC	
1140-1310 (92-311-001)	Thomson
SOC 416 Research Methods	3
Prerequisites: Senior standing, ST 311 or Consent of Instructor	
1140-1310 (92-416-001)	Howell
SOC 425 Juvenile Delinquency	3
Prerequisite: SOC 202, SOC 301 desirable	
0950-1120 (92-425-001)	Della Fave
SOC 498 Special Topics in Sociology	1-6
Prerequisite: Six hours SOC above the 200 level	
Hours arranged (92-498-001)	Sawhney
SOC 501 Leadership	3
Prerequisite: SOC 202 or equivalent	
0800-0930 (92-501-001)	Brisson
SOC 515 Deviant Behavior	3
Prerequisite: Six hours SOC or ANT or Graduate standing or PBS status	
0950-1120 (92-515-001)	Hill
SOC 591 Special Topics in Sociology	1-6
Prerequisite: Consent of Instructor	
Hours arranged (92-591-001)	Moxley
SOC 595 Practicum in Sociology	3-6
Prerequisites: Graduate standing in the Master of Sociology program and nine hours of SOC at the 500-600 level	
Hours arranged (92-595-001)	Moxley
SOC 699 Research in Sociology	Credits Arranged
Prerequisite: Consent of chairman of graduate study committee	
Hours arranged (92-699-001)	Moxley

SECOND SESSION

SOC 202 Principles of Sociology	3
0730-0900 (92-202-001)	Woodrum
0800-0930 (92-202-002)	Drabick
0950-1120 (92-202-003)	Drabick
0950-1120 (92-202-004)	Staff
1140-1310 (92-202-005)	Staff
SOC 202E Principles of Sociology	3
1745-1930 MTuWTh (92-202-006)	Staff

SOC 203 Current Social Problems	3
0800-0930 (92-203-001)	Staff
SOC 204 Sociology of Family	3
0800-0930 (92-204-001)	Staff
0800-0930 (92-204-002)	Troost
0950-1120 (92-204-003)	Staff
0950-1120 (92-204-004)	Staff
1140-1310 (92-204-005)	Staff
SOC 204E Sociology of Family	3
1745-1930 MTuWTh (92-204-006)	Staff
1945-2130 MTuWTh (92-204-007)	Staff
SOC 301 Human Behavior	3
Prerequisite: SOC 202 or PSY 200	
0800-0930 (92-301-001)	Hyman
0950-1120 (92-301-002)	Hyman
SOC 305 Race and Ethnic Relations	3
Prerequisite: Three credits in SOC	
0950-1120 (92-305-001)	Woodrum
SOC 306 Criminology	3
Prerequisite: Three credits in SOC	
0800-0930 (92-306-001)	Suval
SOC 425 Juvenile Delinquency	3
Prerequisite: SOC 202, SOC 301 desirable	
0950-1120 (92-425-001)	Suval
SOC 498A Special Topics in Sociology	1-6
Prerequisite: Six hours SOC above the 200 level	
Hours arranged (92-498-001)	Sawhney
SOC 503 Contemporary Sociology	3
Prerequisite: Graduate standing or PBS status	
1140-1310 (92-503-001)	Marsh
SOC 541E Social Systems and Planned Change	3
Prerequisite: Three hours SOC	
1745-1930 MTuWTh (92-541-001)	Marsh
SOC 591A Special Topics in Sociology	1-6
Prerequisite: Consent of Instructor	
Hours arranged (92-591-001)	Moxley
SOC 595 Practicum in Sociology	3-6
Prerequisites: Graduate standing in the Master of Sociology program and nine hours of SOC at the 500-600 level.	
Hours arranged (92-595-001)	Moxley
SOC 699 Research in Sociology	Credits Arranged
Prerequisite: Consent of chairman of graduate study committee	
Hours arranged (92-699-001)	Moxley
ADULT EDUCATION SESSION	
SOC 498B Special Topics in Sociology: Changing Families in the '80's	3
0950-1250 (92-498-002)	Troost
SOC 591B Special Topics in Sociology: Social & Demographic Change	1
1300-1600 (92-591-002)	Lilley
July 23-July 27	

Speech-Communication

FIRST SESSION

SP 100 Foundations of Communication Theory	3
0800-0930 (37-100-001)	Anderson/Elleman
SP 110 Public Speaking	3
0800-0930 (37-110-001)	Camp
0950-1120 (37-110-002)	Camp
0950-1120 (37-110-003)	DeJoy
1140-1310 (37-110-004)	DeJoy
SP 112 Interpersonal Communication	3
0800-0930 (37-112-001)	Munn
0950-1120 (37-112-002)	Munn
0950-1120 (37-112-003)	Leonard
1140-1310 (37-112-004)	Leonard
SP 204 Writing for the Electronic Media	3
0800-0930 (37-204-001)	Alchediak
SP 322 Nonverbal Communication	3
0950-1120 (37-322-001)	Anderson
SP 354 Portable Video Production	3
1000-1230 (37-354-001)	Alchediak

SECOND SESSION

SP 101 Speech Improvement	3
0950-1120 (37-101-001)	Schumacher
SP 103 Introduction to the Theatre	3
0800-0930 (37-103-001)	Russell
SP 110 Public Speaking	3
0800-0930 (37-110-001)	Franklin
0950-1120 (37-110-002)	Franklin
0950-1120 (37-110-003)	Parker
1140-1310 (37-110-004)	Parker
SP 112 Interpersonal Communication	3
0800-0930 (37-112-001)	Staff
0950-1120 (37-112-002)	Staff
1140-1310 (37-112-003)	Staff
SP 200 Introduction to Communication Inquiry	3
0800-0930 (37-200-001)	Schrag
SP 203 Theory and Practice of Acting	3
0950-1120 (37-203-001)	Russell
SP 214 Introduction to Radio Production	3
0950-1120 (37-214-001)	Funkhouser
SP 304 Survey of Telecommunication	3
1140-1310 (37-304-001)	Funkhouser
SP 498C Special Topics in Speech-Communication: Television Criticism for Parents/Teachers	3
Prerequisite: Nine hours of speech	
0950-1120 (37-498-001)	Schrag

Soil Science

FIRST SESSION

SSC 590 Special Problems

Prerequisite: SSC 200

Hours arranged (93-590-001)

Credits Arranged

Staff

SSC 699 Research

Prerequisite: Graduate standing in Soil Science

Hours arranged (93-699-001)

Credits Arranged

Staff

SECOND SESSION

SSC 590 Special Problems

Prerequisite: SSC 200

Hours arranged (93-590-001)

Credits Arranged

Staff

SSC 699 Research

Prerequisite: Graduate standing in Soil Science

Hours arranged (93-699-001)

Credits Arranged

Staff

Statistics

FIRST SESSION

ST 311 Introduction to Statistics

0950-1120 (94-311-001)

3

Stines

ST (EB) 350 Economics and Business Statistics

Prerequisites: MA 113 or MA 112; MA 114; EB 201 or EB 212

0800-0930 (94-350-001)

3

Wilson

ST 361 Introduction to Statistics for Engineers

Prerequisite: College Algebra

0800-0930 (94-361-001)

3

Dietz

ST 371 Introduction to Probability and Distribution Theory

Prerequisite: MA 201

0950-1120 (94-371-001)

3

Wesler

ST 493 Special Topics in Statistics

Prerequisite: Consent of Instructor

Hours arranged (94-493-001)

1-3

Staff

ST 511S Experimental Statistics I

Prerequisite: ST 311 or Graduate standing

1140-1310 (94-511-001)

3

Pollock

ST 515 Experimental Statistics for Engineers

Prerequisite: ST 361 or Graduate standing

0950-1120 (94-515-001)

3

Hader

ST (MA) 541 Theory of Probability I

Prerequisite: MA 425 or MA 511

0800-0930 (94-541-001)

3

Wesler

ST 591 Special Problems

Hours arranged (94-591-001)

1-3

Staff

ST 691 Advanced Special Problems

Prerequisites: ST 402 or equivalent, ST 552

Hours arranged (94-691-001)

1-3

Staff

ST 699 Research	Credits Arranged
Hours arranged (94-699-001)	Staff

SECOND SESSION

ST 372 Introduction to Statistical Inference and Regression	3
Prerequisite: ST 371	
0950-1120 (94-372-001)	Ridgeway

ST 512S Experimental Statistics II	3
Prerequisite: ST 511 or equivalent	
0800-0930 (94-512-001)	Briggs

ST 516 Experimental Statistics for Engineers	3
Prerequisite: ST 361 or Graduate standing	
0950-1120 (94-516-001)	Manson

ST 591 Special Problems	1-3
Prerequisite: Consent of Instructor	
Hours arranged (94-591-001)	Staff

ST 691 Advanced Special Problems	1-3
Prerequisites: ST 402 or equivalent, ST 552	
Hours arranged (94-691-001)	Staff

ST 699 Research	Credits Arranged
Hours arranged (94-699-001)	Staff

Social Work

FIRST SESSION

SW 406 Field Work I	6
Prerequisite: SW 405	
LR Hours arranged (86-406-001)	Williams
LB Hours arranged (86-406-101)	

SW 498 Special Topics in Social Work	1-6
Prerequisite: Nine hours of Social Work. Social Work students only.	
Hours arranged (86-498-001)	Reid

SECOND SESSION

SW 407 Field Work II	6
Prerequisite: SW 406	
LR Hours arranged (86-407-001)	Reid/Williams
LB Hours arranged (86-407-101)	

SW 498 Special Topics in Social Work	1-6
Prerequisite: Nine hours of Social Work. Social Work students only.	
Hours arranged (86-498-001)	Reid

Textile Chemistry

FIRST SESSION

T 203 Introduction to Polymer Chemistry	3
Prerequisite: CH 101	
0800-0930 (95-203-001)	Staff

TC 490 Special Topics in Textile Chemistry	1-6
Hours arranged (96-490-001)	Livengood

TC 591 Special Topics in Textile Science	1-4
Prerequisites: Senior or Graduate standing and Consent of Instructor	
Hours arranged (96-591-001)	Cates
TC 699 Textile Research for Textile Chemistry	Credits Arranged
Hours arranged (96-699-001)	Cates

SECOND SESSION

T 493 Industrial Internship in Textiles	3
Prerequisite: Textile Core Courses. Limited to 3 hours as Free Elective.	
Hours arranged (95-493-001)	Robinson
TC 490 Special Topics in Textile Chemistry	1-6
Hours arranged (96-490-001)	Livengood
TC 591 Special Topics in Textile Science	1-4
Prerequisites: Senior or Graduate standing and Consent of Instructor	
Hours arranged (96-591-001)	Cates
TC 699 Textile Research for Textile Chemistry	Credits Arranged
Hours arranged (96-699-001)	Cates

Textile Materials and Management

FIRST SESSION

T 220 Yarn Production Systems	3
Prerequisites: T 105 and MA 111 or equivalent	
LR 0950-1050 (95-220-001)	Banks-Lee
LB 1340-1620 TuTh (95-220-101)	
TX 490 Development Project in Textile Technology	2-3
Prerequisites: Senior standing and 2.75 GPA	
Hours arranged (97-490-001)	Hutchison
TX 590 Special Project in Textiles	2-3
Prerequisites: Senior or Graduate standing and Consent of Instructor	
Hours arranged (97-590-001)	Gupta
TX 621 Advanced Textile Testing	3
Prerequisites: TX 530, ST 421 or Consent of Instructor	
LR 0910-1010 (97-621-001)	Stuckey
LB 1340-1620 TuTh (97-621-101)	
TX 697 Independent Study in Textiles	3
Hours arranged (97-697-001)	Gupta
TX 699 Textile Thesis/Dissertation Research	Credits Arranged
Hours arranged (97-699-001)	Gupta

SECOND SESSION

T 105 Introduction to Textile Material Science	3
LR 0950-1050 (95-105-001)	Clapp
PR 1340-1620 MW (95-105-201)	
T 250 Textile Fabrics: Formation and Structure	3
Prerequisites: T 105 and MA 111 or equivalent	
LR 0800-0900 (95-250-001)	Donaldson
LB 1340-1620 TuTh (95-250-101)	

T 493 Industrial Internship in Textiles	3
Prerequisite: Textile Core Courses. Limited to 3 hours as Free Elective	
Hours arranged (95-493-001)	Robinson
TX 490 Development Project in Textile Technology	2-3
Prerequisites: Senior standing and 2.75 GPA	
Hours arranged (97-490-001)	Hutchison
TX 590 Special Projects in Textiles	2-3
Prerequisites: Senior or Graduate standing and Consent of Instructor	
Hours arranged (97-590-001)	Gupta
TX 697 Independent Study in Textiles	3
Hours arranged (97-697-001)	Gupta
TX 699 Textile Thesis/Dissertation Research	Credits Arranged
Hours arranged (97-699-001)	Gupta

University Studies

FIRST SESSION

UNI 301 Science and Civilization	3
Prerequisite: Sophomore standing	
0800-0930 (89-301-001)	Stalnaker
0950-1120 (89-301-002)	Stalnaker
1140-1310 (89-301-003)	Hoffman
UNI 302 Contemporary Science and Human Values	3
Prerequisite: Sophomore standing	
0800-0930 (89-302-001)	Korte
0950-1120 (89-302-002)	Korte
UNI 324 Alternative Futures	3
0950-1120 (89-324-001)	Hoffman

SECOND SESSION

UNI 301 Science and Civilization	3
Prerequisite: Sophomore standing	
0800-0930 (89-301-001)	Bonham
0950-1120 (89-301-002)	Bonham
UNI 302 Contemporary Science and Human Values	3
Prerequisite: Sophomore standing	
0800-0930 (89-302-001)	Huisingh
UNI 303 Humans and the Environment	3
0950-1120 (89-303-001)	Huisingh

Veterinary Medical Sciences

FIRST SESSION

VMS 590 Special Topics in Veterinary Medical Sciences	1-3
Prerequisite: Senior or Graduate standing	
Hours arranged (84-590-001)	Bentley/Berkhoff/Brown/Henrikson
VMS 690B Special Topics in Pathology	1-4
Prerequisites: DVM degree and Consent of Instructor	
Hours arranged (84-690-001)	Brown/Staff

VMS 690C Special Topics in Laboratory Pharmacology	1-3
Prerequisites: Graduate standing and Consent of Instructor	
Hours arranged (84-690-002)	Bentley/Staff
VMS 694B Seminar in Surgical Pathology	1
Prerequisites: DVM or equivalent degree and Consent of Instructor	
Hours arranged (84-694-001)	Brown/Staff
SECOND SESSION	
VMS 590 Special Topics in Veterinary Medical Sciences	1-3
Prerequisite: Senior or Graduate standing	
Hours arranged (84-590-001)	Bentley/Berkhoff/Brown/Henrikson
VMS 690B Special Topics in Pathology	1-4
Prerequisites: DVM degree and Consent of Instructor	
Hours arranged (84-690-001)	Brown/Staff
VMS 690C Special Topics in Laboratory Pharmacology	1-3
Prerequisites: Graduate standing and Consent of Instructor	
Hours arranged (84-690-002)	Bentley/Staff
VMS 694B Seminar in Surgical Pathology	1
Prerequisites: DVM or equivalent degree and Consent of Instructor	
Hours arranged (84-694-001)	Brown/Staff

Veterinary Medicine

FIRST SESSION

VMA 490 Special Topics in Anatomy, Physiological Sciences and Radiology	1-6
Hours arranged (08-490-001)	Staff
VMF 490 Special Topics in Food Animal and Equine Medicine	1-6
Hours arranged (72-490-001)	Staff
VMM 490 Special Topics in Microbiology, Pathology and Parasitology	1-6
Hours arranged (91-490-001)	Staff

SECOND SESSION

VMA 490 Special Topics in Anatomy, Physiological Sciences and Radiology	1-6
Hours arranged (08-490-001)	Staff
VMF 490 Special Topics in Food Animal and Equine Medicine	1-6
Hours arranged (72-490-001)	Staff
VMM 490 Special Topics in Microbiology, Pathology and Parasitology	1-6
Hours arranged (91-490-001)	Staff

Wood and Paper Science

FIRST SESSION

WPS 205 Wood Products Practicum	5
WST Summer Practicum	
Prerequisite: WPS 201 or WPS 202	
0800-1700 (90-205-001)	Gilmore/Kelly
May 14-June 25—Five-Week Course	

WPS 210 Forest Products Internship	1
Prerequisite: Completion of Summer Practicum 0800-1700 (90-210-001)	Kelly
WPS 491 Senior Problems in Wood & Paper Science	Credits Arranged
Prerequisite: Consent of department Hours arranged (90-491-001)	Staff
WPS 591 Wood and Paper Science Problems	Credits Arranged
Prerequisite: Senior or Graduate standing Hours arranged (90-591-001)	Staff
WPS 693 Advanced Wood and Paper Science Problems	Credits Arranged
Prerequisite: Graduate standing Hours arranged (90-693-001)	Staff
WPS 699 Problems and Research	Credits Arranged
Prerequisite: Graduate standing Hours arranged (90-699-001)	Staff
SECOND SESSION	
WPS 491 Senior Problems in Wood & Paper Science	Credits Arranged
Prerequisite: Consent of department Hours arranged (90-491-001)	Staff
WPS 591 Wood and Paper Science Problems	Credits Arranged
Prerequisite: Senior or Graduate standing Hours arranged (90-591-001)	Staff
WPS 693 Advanced Wood and Paper Science Problems	Credits Arranged
Prerequisite: Graduate standing Hours arranged (90-693-001)	Staff
WPS 699 Problems and Research	Credits Arranged
Prerequisite: Graduate standing Hours arranged (90-699-001)	Staff

Zoology

FIRST SESSION

BS 100 General Biology	4
(See Biological Sciences)	
ZO 201 General Zoology	4
Prerequisite: BS 100 or BS 105 LR 0800-0930 (99-201-001)	Allen
LB 1340-1750 MW (99-201-101) LB 1340-1750 TuTh (99-201-102)	
ZO 212 Basic Anatomy and Physiology	4
Prerequisite: BS 100 (Only free elective credit will be allowed for students majoring in the Biological Sciences, Zoology, Conservation, and Wildlife Biology).	
LR 0950-1120 (99-212-001)	Staff
LB 1340-1750 MW (99-212-101)	
ZO (FW) 221 Conservation of Natural Resources	3
(See Fisheries and Wildlife)	
ZO (BO) 360 Introduction to Ecology	4
Prerequisite: A 200-level biology course LR 0950-1120 (99-360-001)	Zeveloff
LB 1340-1750 MW (99-360-101)	

ZO 590 Special Studies	Credits Arranged
Prerequisites: Twelve hours in Zoology and Consent of Instructor	
Hours arranged (99-590-001)	Vandenbergh
ZO 699 Research in Zoology	Credits Arranged
Prerequisites: Twelve hours in Zoology and Consent of Instructor	
Hours arranged (99-699-001)	Vandenbergh
SECOND SESSION	
ZO 303 Vertebrate Zoology	4
Prerequisite: BS 100 or BO 200	
LR 0950-1120 (99-303-001)	Massey
LB 1340-1750 MW (99-303-101)	
LB 1340-1750 TuTh (99-303-102)	
ZO 421E Vertebrate Physiology	3
Prerequisites: CH 223, PY 212, ZO 201, or ZO 303	
1910-2200 MTuWTh (99-421-001)	Ammann
ZO 590 Special Studies	Credits Arranged
Prerequisites: Twelve hours in Zoology and Consent of Instructor	
Hours arranged (99-590-001)	Vandenbergh
ZO 699 Research in Zoology	Credits Arranged
Prerequisites: Twelve hours in Zoology and Consent of Instructor	
Hours arranged (99-699-001)	Vandenbergh

UNIVERSITY CRAFT CENTER COURSES

The following noncredit, special interest courses are being offered through the cooperation of the University Craft Center, Lower Level, Frank Thompson Building. Telephone (919) 737-2457

NOTE: *Regularly enrolled North Carolina State University students are given priority for the Craft Center courses.* ALL REGISTRATIONS ARE TO BE MADE AT THE CRAFT CENTER: Wednesday, May 23, 1984, 12:30-7:30 p.m., or until all spaces in classes have been filled.

COURSE OFFERINGS AND CLASS SCHEDULE

CLASS DATES TO BE SCHEDULED: for information, call 737-2457

POTTERY I USING THE POTTERS WHEEL

Course Description: Construction of coiled, slab and pinched pots as well as use of the potters' wheel. Lectures will cover nature of clay and various materials used by the potter as related to function and form.

POTTERY II MAKING BETTER POTS

Course Description: Designed to follow Pottery I. Must have experience on the potters' wheel. Emphasis on form and construction techniques. Individual study of projects and critique.

DRAWING

Course Description: Exploring drawing; using pencil, charcoal, and ink. Figure study introduced.

CALLIGRAPHY

Course Description: Italic and decorative writing. Introduction to Roman, Gothic and old English text, with emphasis on italic script.

BASKETRY-WICKER WORK

Course Description: Students will learn to construct at least three small baskets, using different techniques and materials. Fee includes materials for these sample baskets.

BLACK AND WHITE PHOTOGRAPHIC PROCESSING I

Course Description: Basic developing techniques used for B/W film, contact printing and enlargement.

PHOTOGRAPHY—CAMERA OPERATION AND CARE

Course Description: Lecture/demonstration covering the care and cleaning of cameras and lenses, light meter techniques, shutter speeds and f/stop combinations, depth of field, filters, perspective control, etc.

ALL PUBLIC AREAS OF THE BUILDING ARE WHEELCHAIR ACCESSIBLE. SPECIAL EQUIPMENT AND TOOLS HAVE BEEN INSTALLED TO FACILITATE USE BY THE HANDICAPPED INDIVIDUAL. IF SPECIAL NEEDS ARE ANTICIPATED, PLEASE NOTIFY THE DIRECTOR OR HIS STAFF AT REGISTRATION.

COLOR PRINTING

Course Description: Lectures detail basic color printing from color negatives and slides. Color negative printing emphasized. Cibachrome introduced.

WATERCOLOR

Course Description: Section (A): introduction to watercolor techniques, preparation of work-surfaces, exploring transparent and opaque methods; use of space, color, and form. Practice paper will be available in class time. Students should plan to buy their own supplies after first meeting.

WOOD: Basic Use of Tools

Course Description: Small projects only will be completed in this class. The safe use of power tools is emphasized.

TECHNIQUES FOR HANDCRAFTING FINE FURNITURE

Course Description: Designed for people with basic wood-working knowledge, who want to improve their skill in furniture making. Students choose a project from a variety of simple furniture pieces including side tables, hutch tables, butlers trays, shaker benches, candle stands, and others. Instruction will cover hand dovetail joints, hand inlay, individual construction techniques, etc.

REMINDER: Registration will take place at the Craft Center in the basement of the Frank Thompson Building on May 23, 1984, 12:30-7:30 p.m., or until all spaces in classes have been filled.

Contact the Craft Center for the complete summer schedule and full details by writing, telephoning or visiting:

The Craft Center
Lower Level, Frank Thompson Building
Corner, Baise and Dunn Streets
North Carolina State University
Box 7305
Raleigh, North Carolina 27695-7305
Telephone: (919) 737-2457





SUMMER SESSIONS FACULTY

A

R.N. Abbott, Jr., Ph.D., Visiting Assistant Professor, Marine, Earth and Atmospheric Sciences
 Charlie Frank Abrams, Jr., Ph.D., Associate Professor, Biological and Agricultural Engineering
 D.A. Adams, Ph.D., Associate Professor, Forestry
 E.M. Afify, Ph.D., Professor, Mechanical and Aerospace Engineering
 James Alchediak, M.A., Lecturer, Speech-Communication
 Ruth Alder, Ph.D., Assistant Professor, Foreign Languages and Literatures
 S. Thomas Alexander, Ph.D., Assistant Professor, Electrical and Computer Engineering
 Richard L. Alfred, D.Ed., Visiting Associate Professor, Adult and Community College Education
 S.L. Allen, M.S., Visiting Instructor, Zoology
 Silvia Alonso, Ph.D., Assistant Professor, Foreign Languages and Literatures
 H.M. Ammann, Ph.D., Visiting Assistant Professor, Zoology
 Norman D. Anderson, Ph.D., Professor, Mathematics and Science Education
 Ruth D. Anderson, Ph.D., Assistant Professor, Speech-Communication
 Frank B. Armstrong, Ph.D., Professor, Biochemistry
 John F. Arnold, Ph.D., Assistant Professor, Curriculum and Instruction
 Lyn G. Aubrecht, Ph.D., Adjunct Assistant Professor, Curriculum and Instruction
 Leonard W. Aurand, Ph.D., Professor, Food Science
 David Franklin Austin, M.A., Instructor, Philosophy and Religion

B

Klaus J. Bachmann, Ph.D., Professor, Chemistry
 David Stafford Ball, Ph.D., Associate Professor, Economics and Business
 Hershell Ray Ball, Jr., Ph.D., Associate Professor, Food Science
 D.A. Barber, Ph.D., Assistant Professor, Marine, Earth and Atmospheric Sciences
 James C. Barker, Ph.D., Extension Associate Professor, Biological and Agricultural Engineering
 G.O. Batton, M.E., Lecturer, Mechanical and Aerospace Engineering
 Gerald Robert Baughman, Ph.D., Associate Professor, Biological and Agricultural Engineering
 R.L. Beckmann, Ph.D., Associate Professor, Botany
 William Howard Beezley, Ph.D., Professor, History
 Ray Braman Benson, Jr., Ph.D., Professor, Materials Engineering
 Henry A. Bent, Ph.D., Professor, Chemistry
 Peter J. Bentley, Ph.D., Professor, Veterinary Sciences
 Robert D. Bereman, Ph.D., Professor, Chemistry
 Herman J. Berkhoff, DVM, Ph.D., Professor, Veterinary Medical Sciences
 Andrea Lynn Berle, M.Ed., Assistant Professor, Physical Education
 R.H. Bernhard, Ph.D., Professor, Industrial Engineering
 Leonidas Judd Betts, Ed.D., Associate Professor, English
 William L. Bingham, Ph.D., Associate Professor, Civil Engineering
 Paul Edward Bishop, Ph.D., Assistant Professor, Microbiology
 Philip Everett Blank, Ph.D., Professor, English
 Milton Clay Bliss, M.A., Assistant Director, Music
 George B. Blum, Jr., MAE, Professor, Biological and Agricultural Engineering
 M.A. Boles, Ph.D., Associate Professor, Mechanical and Aerospace Engineering
 Julia C. Bonham, Ph.D., Assistant Professor, University Studies
 Jon Bordner, Ph.D., Professor, Chemistry
 Charles B. Boss, Ph.D., Associate Professor, Chemistry
 Henry Dittimus Bowen, Ph.D., Professor, Biological and Agricultural Engineering
 Lawrence H. Bowen, Ph.D., Professor, Chemistry
 R.R. Braham, M.S., Lecturer, Forestry
 Paul Arnold Bredenberg, Ph.D., Professor, Philosophy and Religion
 Robert C. Brisson, Ph.D., Associate Professor, Sociology and Anthropology
 Joel V. Brothers, M.A.T., Assistant Professor, Physical Education
 H. Larry Brown, M.S., Assistant Professor, Physical Education
 Henry S. Brown, Ph.D., Professor, Marine, Earth and Atmospheric Sciences
 T.H. Brown, M.S., Visiting Instructor, Mechanical and Aerospace Engineering
 Talmage T. Brown, Jr., DVM, Ph.D., Professor, Veterinary Medical Sciences
 Carl Bryan, Ph.D., Lab Supervisor, Chemistry
 Bruce Bublitz, Ph.D., Assistant Professor, Economics and Business
 Sally B. Buckner, Ph.D., Assistant Professor, Curriculum and Instruction
 Carl L. Bumgardner, Ph.D., Professor, Chemistry
 Robert P. Burns, M.A.R.C., Professor, Design

C

Sue P. Calloway, M.Ed., Lecturer, Occupational Education
 L. Raymond Camp, Ph.D., Associate Professor, Speech-Communication
 Roy Eugene Carawan, Ph.D., Associate Professor, Food Science
 Charles Hope Carlton, Ph.D., Professor, History

Halbert H. Carmichael, Ph.D., Professor, Chemistry
 Daniel Edward Carroll, Ph.D., Associate Professor, Food Science
 William Randolph Carter, Ph.D., Professor, Philosophy and Religion
 George Louis Catignani, Ph.D., Assistant Professor, Food Science
 Thomas C. Caves, Ph.D., Associate Professor, Chemistry
 Richard E. Chandler, Ph.D., Professor, Mathematics
 Harvey Johnson Charlton, Ph.D., Assistant Professor, Mathematics
 William A. Cheek, M.S., Lecturer, Physical Education
 Moody Chu, Ph.D., Assistant Professor, Mathematics
 Lung Ock Chung, Ph.D., Associate Professor, Mathematics
 Edward DePriest Clark, Ph.D., Associate Professor, English
 G.C. Cobb, Ph.D., Associate Professor, Physics
 Charles K. Coe, D.P.A., Assistant Professor, Political Science and Public Administration
 A.W. Cooper, Ph.D., Professor and Head, Forestry
 Nelvin E. Cooper, M.E., Associate Professor, Physical Education
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 Dario Cortes, Ph.D., Assistant Professor, Foreign Languages and Literatures
 Walter L. Cox, Jr., Ed.D., Associate Professor, Occupational Education
 James Ernest Crisp, Ph.D., Assistant Professor, History
 Joseph W. Cunningham, Ph.D., Professor, Psychology

D

Mark Anthony Daeschel, Ph.D., Assistant Professor, Food Science
 Robert D. Dahle, Ph.D., Professor, Economics and Business
 John Michael Anthony Danby, Ph.D., Professor, Mathematics
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 Harold L. Davison, M.A.T., Lecturer, Mathematics
 Cleburn G. Dawson, Ph.D., Assistant Professor, Sociology and Anthropology
 M. Keith DeArmond, Ph.D., Professor, Chemistry
 Daniel A. DeJoy, Ph.D., Assistant Professor, Speech-Communication
 L. Richard Della Fave, Ph.D., Associate Professor, Sociology and Anthropology
 James L. DeWitt, M.S., Lecturer, Physical Education
 E. Jacquelin Dietz, Ph.D., Assistant Professor, Statistics
 Walter J. Dobrogosz, Ph.D., Professor, Microbiology
 W.O. Doggett, Ph.D., Professor, Physics
 Lawrence W. Drabick, Ph.D., Professor, Sociology and Anthropology
 Louis Bynum Driggers, M.S., Extension Professor, Biological and Agricultural Engineering
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E

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 Thomas Evans, M.S., Assistant Professor, Physical Education

F

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 Jiang Luh, Ph.D., Professor, Mathematics

M

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Coro Malaxecheverria, M.A., Instructor, Foreign Languages and Literatures
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A. Massey, Ph.D., Research Associate, Zoology
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Joseph McCoy, Ph.D., Visiting Associate Professor, Chemistry
Patrick H. McDonald, Ph.D., Harrelson Professor, Civil Engineering
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W.H. McKenzie, Ph.D., Associate Professor, Genetics
Thoyd Melton, Ph.D., Associate Professor, Microbiology
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Eleanor Ward Miles, M.A., Lecturer, English
Marion L. Miles, Ph.D., Professor, Chemistry
Robert D. Milholland, Ph.D., Professor, Plant Pathology
Nan Dupree Miller, M.A., Lecturer, English
Norman C. Miller, Jr., M.S., Extension Professor, Food Science
William L. Miller, Ph.D., Associate Professor, Biochemistry
Mansour H. Mohamed, Ph.D., Professor, Textiles
Subhas C. Mohapatra, Ph.D., Senior Researcher, Biological and Agricultural Engineering
Catherine Elizabeth Moore, Ph.D., Associate Professor, English
Shanna L. Moore, M.A., Lecturer, Physical Education
James Howell Moorhead, Ph.D., Associate Professor, Philosophy and Religion
Charles G. Moreland, Ph.D., Professor, Chemistry
J.W. Moss, Ph.D., Assistant Professor, Occupational Education
J.R. Mowat, Ph.D., Associate Professor, Physics
J.C. Mulligan, Ph.D., Professor, Mechanical and Aerospace Engineering
Harry E. Munn, Jr., Ph.D., Associate Professor, Speech-Communication
R. David Mustian, Ph.D., Professor, Adult and Community College Education

N

James M. Nau, Ph.D., Associate Professor, Civil Engineering
Gordon Darnell Newby, Ph.D., Associate Professor, History
Craig Newmark, C.Phil., Lecturer, Economics and Business
Paul Adrain Nickel, Ph.D., Professor, Mathematics
Gifford S. Nickerson, Ph.D., Associate Professor, Sociology and Anthropology
Charles A. Nittrouer, Ph.D., Assistant Professor, Marine, Earth and Atmospheric Sciences
Michele Noel, Ph.D., Assistant Professor, Foreign Languages and Literatures
Michael James Novak, Ph.D., Visiting Assistant Professor, History

O

Gail William O'Brien, Ph.D., Assistant Professor, History
Jon F. Ort, Ph.D., Assistant Professor, Poultry Science
Elizabethann O'Sullivan, Ph.D., Assistant Professor, Political Science and Public Administration
H.L. Owen, B.S., Assistant Professor, Physics

P

Janet Taylor Palmer, B.A., Visiting Lecturer, English
Chia-Ven Pao, Ph.D., Professor, Mathematics
Charles A. Parker, Ph.D., Professor, Speech-Communication
G.W. Parker, Ph.D., Associate Professor, Physics
Mary Paschal, Ph.D., Professor, Foreign Languages and Literatures
Victor Guy Paul, M.A., Lecturer, English
Philip M. Pavlik, A.B., Visiting Lecturer, Political Science and Public Administration
Robert Lynn Peace, J.D., Lecturer, Economics and Business
Richard G. Pearson, Ph.D., Professor, Industrial Engineering
R. James Peeler, Jr., Ph.D., Professor, Economics and Business
Jerome John Perry, Ph.D., Professor, Microbiology
T.O. Perry, Ph.D., Professor, Forestry
Howard Aldridge Petrea, M.A., Associate Professor, Mathematics
Robert B. Petters, Ph.D., Assistant Director, Music

Dwain Harvey Pilkington, Ph.D., Assistant Professor, Food Science
 Kenneth H. Pollock, Ph.D., Associate Professor, Statistics
 S.B. Pond III, Ph.D., Assistant Professor, Psychology
 Susan Bittner Pond, M.A., Lecturer, English
 Ruie J. Pritchard, Ph.D., Assistant Professor, Curriculum and Instruction
 J.N. Perkins, Ph.D., Professor, Mechanical and Aerospace Engineering
 Beryl Cox Pittman, B.S., Visiting Lecturer, English
 Anco Prak, Ph.D., James T. Ryan Professor, Industrial Engineering
 Anne Marie Prendergast, M.A., Visiting Lecturer, English
 Gregory N. Prygrocki, M.V.A., Associate Professor, Design
 Suzanne Purrington, Ph.D., Assistant Professor, Chemistry

R

Robert Todd Ramsay, Ph.D., Assistant Professor, Mathematics
 J. Patrick Rand, M.A.R.C., Associate Professor, Design
 Parviz Rastgoufard, Ph.D., Visiting Assistant Professor, Electrical and Computer Engineering
 P. Nelson Reid, Ph.D., Associate Professor, Sociology and Anthropology
 Traciell V. Reid, M.A., Lecturer, Political Science and Public Administration
 Joel D. Register, M.A., Lecturer, English
 Carol L. Retzlaff, M.S., Lecturer, Physical Education
 Max S. Rhodes, M.A., Assistant Professor, Physical Education
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 A.J. Riordan, Ph.D., Associate Professor, Marine, Earth and Atmospheric Sciences
 Danny Lee Robinson, M.A., Lecturer, English
 Jo Ann Rockness, Ph.D., Assistant Professor, Economics and Business
 Jesus Rodriguez, Ph.D., Assistant Professor, Mathematics
 Roger P. Rohrbach, Ph.D., Professor, Biological and Agricultural Engineering
 E. William Rollins, Ph.D., Associate Professor, Foreign Languages and Literatures
 W.A. Ross, M.Ed., Visiting Instructor, Occupational Education
 Irwin Rovner, Ph.D., Assistant Professor, Sociology and Anthropology
 John Eual Rushing, Ph.D., Assistant Professor, Food Science
 Burton Russell, Ph.D., Associate Professor, Speech-Communication
 Bobby Glen Ruth, B.A., Lecturer, English

S

Ekkehard W. Sachs, Ph.D., Assistant Professor, Mathematics
 Hans Sagan, Ph.D., Professor, Mathematics
 Robert G. Savage, M.S., Associate Professor, Mathematics
 Anton F. Schreiner, Ph.D., Professor, Chemistry
 Robert L. Schrag, Ph.D., Assistant Professor, Speech-Communication
 Mike Leroy Schroeder, M.A., Lecturer, English
 Steven Jay Schwartz, Ph.D., Assistant Professor, Food Science
 James Francis Selgrade, Ph.D., Associate Professor, Mathematics
 C. John Setzer, Ph.D., Associate Professor, Chemical Engineering
 Jack L. Shannon, M.S., Assistant Professor, Physical Education
 W. Michael Shea, M.Ed., Assistant Professor, Physical Education
 Brian William Sheldon, Ph.D., Assistant Professor, Food Science
 Douglas Dean Short, Ph.D., Professor, English
 Robert Silber, Ph.D., Associate Professor, Mathematics
 Anastatia Sims, M.A., Visiting Instructor, History
 Edward C. Sisler, Ph.D., Professor, Biochemistry
 Richard W. Skaggs, Ph.D., Professor, Biological and Agricultural Engineering
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 Frank J. Smith, Ph.D., Associate Professor, Psychology
 J.C. Smith, Ph.D., Associate Professor, Civil Engineering
 John David Smith, Ph.D., Assistant Professor, History
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Y

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Z

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A

Access Key

- can be entered by an individual in a wheelchair with no assistance
- can be entered by an individual in a wheelchair with minimum assistance

N, S, E, W,—indicates side of building with accessible entrance
 □ passenger elevator.

■ freight elevator.

- freight elevator.
- accessible toilet.

ACCESS	NO.	BUILDING NAME
	1	Alexander Residence Hall
	2	Alumni Memorial Building
	3	Bagwell Residence Hall
	4	Becton Residence Hall
E	5	Berry Residence Hall
	6	Biltmore Hall
	7	Bowen Residence Hall
	8	Bragaw Residence Hall
● N, □ T	9	Brooks Hall
● N	10	Brooks Hall Addition
● N, ■	11	Broughton Hall
○ N, □	12	Burlington Engineering I
E	13	Bureau of Weights and Measures
	14	Carmichael Gymnasium
	15	Carroll Residence Hall
● N	16	Case Athletics Center
	17	Central Stores
	18	Chancellor's Residence



ACCESS	NO.	BUILDING NAME	GRID	CODE
● W, □, T	19	Clark Hall Infirmary	2-C	
○ S, ■	20	Clark Laboratories	5-D	CL
○ N, T	21	Cox Hall	4-D	COX
○ N, T	22	Cultural Center	5-D	
● N, □	23	Dabney Hall	4-D	DAB
● W, ■	24	Daniels Hall	4-C	DAN
● W, □, T	25	McKimmion Extension Continuing Education Center	5-F	
	26	Farm Unit 5	6-F	
○ N	27	Field House	2-C	
	28	Fraternity Court	4-F	
○ S, ■	29	Gardner Hall	5-D	GA
● N, □, T	30	Boslian Hall	5-D	
	31	Gold Residence Hall	2-C	
	32	Greenhouse—Agronomy	5-D	AGH
	33	Greenhouse—Biological Sciences	5-D	BSG
	34	Greenhouse—Horticulture	5-D	HGH
	35	Greenhouse—840 Method Rd	8-F	
	36	Greenhouse—Plant Pathology	5-D	PPG
○ E	37	Grinnalls Animal Health Lab	5-E	GHL
● N, □, T	38	Harrelson Hall	5-D	HA
● N, □, T	39	Harris Hall	5-C	
W, □	40	D. H. Hill Library—Original Wing	5-C	DHL
○ W, □, T	41	D. H. Hill Library—Book Stack Tower	5-C	
● N, S, □	42	D. H. Hill Library—Erdahl-Cloyd Wing	5-C	
		North Campus Bookshop	5-C	
● N, □, T	43	Hillsborough Building	5-C	HLB
○ W	44	Hodges Wood Products Lab	4-E	HWP
	45	Holladay Hall	2-B	
	46	Information Center, Visitor Parking	2-B	
S, ■	47	Kilgore Hall	3-C	KI
	48	Laundry	3-C	
	49	Leazar Hall	3-B	LEZ
	50	Lee Residence Hall	5-E	
● S, □	51	Mann Hall	4-C	MN
	52	E. S. King Village (17 Apt Bldgs A-Q)	7-F	
	53	Memorial Tower	3-A	
	54	Metcalf Residence Hall	3-D	
● S	55	Morris Building	3-C	

ACCESS	NO.	BUILDING NAME	GRID	CODE
○ E, ■	56	Nelson Textile Building	6-D	N
	57	1911 Building	4-C	
	58	Owen Residence Hall	4-D	
○ E	59	Page Hall	3-C	PA
○ W	60	Park Shops	3-C	PS
○ S	61	Patterson Hall	4-C	PT
● E	62	Peele Hall	3-B	
	63	Physical Plant Maint. Center	7-E	
	64	Physical Plant Shops (Armory)	4-D	
○ E	65	Phytotron	5-D	PHY
○ E, □	66	Poe Hall	3-C	POE
● N, □	67	Polk Hall	4-C	PK
○ S	68	Power Plant	3-C	
● W, T	69	Price Music Center	4-D	PMC
○ S, T	70	Primrose Hall	3-B	
	71	Print Shop/University Graphics	6-E	
● E	72	Quad, Snack Bar	2-C	
○ E, T	73	Wm. Neal Reynolds Coliseum	3-D	
○ E, □	74	Ricks Hall	4-C	RI
○ N, ■	75	Riddick Engineering Labs	3-C	RD
	76	Riddick Stadium	3-C	
○ E	77	Robertson Wing, Biltmore Hall	4-E	
○ S, □	78	Schaub Food Science Building	4-E	SFS
○ S, ■	79	Scott Hall	5-D	SC
	80	Steam Plant	4-E	
	81	Students Supply Stores	4-D	
	82	Sullivan Residence Hall	6-E	
	83	Syme Residence Hall	2-C	
	84	Television Center	6-F	TVS
○ E	85	Thompson Theatre/Craft Center	2-C	TT
○ N, S	86	Tompkins Hall	3-B	T
	87	Tucker Residence Hall	4-D	
	88	Turlington Residence Hall	4-D	
	89	Turner House	6-C	
○ S, □, T	90	University Student Center	3-D	USC
○ W, ■	91	Watuga Hall	2-B	
	92	Weaver Laboratories	5-E	DSW
	93	Weed Control Laboratories	8-F	
○ S, ■	94	Welch Residence Hall	2-C	
○ N, S	95	Williams Hall	5-D	WMS
○ E, ■	96	Winston Hall	4-B	WN
○ E, □	97	Withers Hall	4-C	WI
● E, □	98	North Residence Hall	3-A	
● S, □, T	99	Link	4-B	
● E, □, T	100	Weisiger-Brown Athl. Facility	2-D	
● E, T	101	Residence Hall (in construction)	3-D	
● E, T	102	Dining Hall	5-E	
● N, T	103	Solar Demonstration House	5-F	

COURTS AND FIELDS

	GRID
A. Bagwell-Becton-Berry Quad	2-C
B. Gold-Welch-Syme-Brooks Court	2-C
C. Holladay Hall Court	3-B
D. Court of North Carolina	3-B
E. Gardner Arboretum	4-C
F. University Plaza (Brickyard)	3-C
G. University Student Center Plaza	4-D
H. Urrington-Alexander Court	4-D
I. Tucker-Owen Court	4-D
J. Lee-Sullivan-Bragaw Court	5-E
K. Fraternity Court	4-F
L. E. S. King Village Court	7-F
M. Paul H. Derr Track	2-D
N. Miller Fields	4-E
O. Doak Field	8-E
P. McKimmion Center Court	5-F
R. The Big Acre	8-F

PARKING LOTS

	GRID
Brooks Ave Lot	6-C
Carmichael Lot	3-D
Coliseum Bays	3-D
East Coliseum Lot	2-C
Freindly Drive Lot	6-D
Harris Lot	4-E
Hillsborough Building Lots	6-C
Parking Deck	2-C
Riddick Lot	3-C
Sullivan Lots	6-E
West Lot	6-E
Additional West Lot Parking	5-E
Yarbrough Lot	3-C



Director of Summer Sessions
North Carolina State University
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BULLETIN

**North Carolina State University
1984-1986 Graduate Catalog**



Prominent in the above aerial of the central North Carolina State University campus are three high-rise residence halls (foreground), the circular Harrelson Hall with the adjacent towers of Cox and Dabney Halls, and in the upper left, the tower of the D. H. Hill Library. The central campus encompasses some 623 acres.

NORTH CAROLINA STATE UNIVERSITY BULLETIN

VOLUME 83

DECEMBER 1983

NUMBER 4

(USPS 393-040)

Published four times a year in February, June, August and December by North Carolina State University, Department of Admissions, Peele Hall, Box 7103, Raleigh, N. C. 27695-7103. Second class postage paid at Raleigh, N. C. 27611.



North Carolina State University
Raleigh, North Carolina

Graduate Catalog
1984-86

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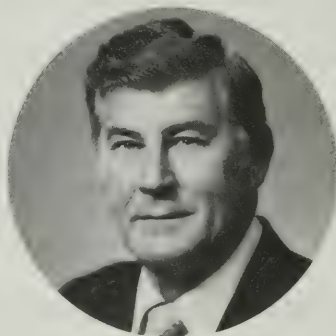
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*Dr. Jasper D. Memory
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and Dean of the Graduate School*



THE CALENDAR*

FALL SEMESTER, 1983

August 25	Thurs.	Registration day.
August 26	Fri.	Change day (late registration, drop/add).
August 29	Mon.	First day of classes.
September 5	Mon.	Holiday.
September 12	Mon.	Last day to add a course; last day to withdraw or drop a course with a refund.
September 26	Mon.	Last day to drop a course at the 400 level or below without a grade.
October 14	Fri.	Mid-semester reports due; fall vacation begins at 10 p.m.
October 19	Wed.	Classes resume at 7:50 a.m.
October 28	Fri.	Last day to drop a course at the 500 or 600 level without a grade.
November 11	Fri.	<i>Deadline for submission of theses to the Graduate School in final form as approved by advisory committees by candidates for master's and doctoral degrees in December, 1983. Last day for unconditional pass on final oral examinations by candidates for master's degrees not requiring theses.</i>
November 23	Wed.	Thanksgiving vacation begins at 1 p.m.
November 28	Mon.	Classes resume at 7:50 a.m.
December 9	Fri.	Last day of classes.
December 12-20	Mon.-Tues.	Final examinations.

SPRING SEMESTER, 1984

January 9	Mon.	Registration day.
January 10	Tues.	Change day (late registration, drop/add).
January 11	Wed.	First day of classes.
January 25	Wed.	Last day to add a course; last day to withdraw or drop a course with a refund.
February 8	Wed.	Last day to drop a course at the 400 level or below without a grade.
March 2	Fri.	Mid-semester reports due; spring vacation begins at 10 p.m.
March 12	Mon.	Classes resume at 7:50 a.m.
March 16	Fri.	Last day to drop a course at the 500 or 600 level without a grade.
March 30	Fri.	<i>Deadline for submission of theses to the Graduate School in final form as approved by ad-</i>

*Dates indicated are subject to change.

		<i>visory committees by candidates for master's and doctoral degrees in May, 1984. Last day for unconditional pass on final oral examinations by candidates for master's degrees not requiring theses.</i>
April 23	Mon.	Holiday
April 27	Fri.	Last day of classes.
April 30-May 8	Mon.-Tues.	Final examinations.
May 12	Sat.	Commencement.

SUMMER SESSIONS, 1984*First Session*

May 22	Tues.	Registration day.
May 23	Wed.	First day of classes.
May 28	Mon.	Last day to add a course; last day to withdraw or drop a course with a refund.
June 1	Fri.	Last day to drop a course at the 400 level or below without a grade.
June 8	Fri.	Last day to drop a course at the 500 or 600 level without a grade.
June 26	Tues.	Last day of classes.
June 27	Wed.	Final examinations.

Second Session

July 5	Thurs.	Registration day.
July 6	Fri.	First day of classes.
July 11	Wed.	Last day to add a course; last day to withdraw or drop a course with a refund.
July 12	Thurs.	<i>Deadline for submission of theses to the Graduate School in final form as approved by advisory committees by candidates for master's and doctoral degrees in August, 1984. Last day for unconditional pass on final oral examinations by candidates for master's degrees not requiring theses.</i>
July 17	Tues.	Last day to drop a course at the 400 level or below without a grade.
July 24	Tues.	Last day to drop a course at the 500 or 600 level without a grade.
August 9	Thurs.	Last day of classes.
August 10	Fri.	Final examinations.

FALL SEMESTER, 1984

August 23	Thurs.	Registration day.
August 24	Fri.	Change day (late registration, drop/add).

August 27	Mon.	First day of classes.
September 3	Mon.	Holiday.
September 10	Mon.	Last day to add a course; last day to withdraw or drop a course with a refund.
September 24	Mon.	Last day to drop a course at the 400 level or below without a grade.
October 12	Fri.	Mid-semester reports due; fall vacation begins at 10 p.m.
October 17	Wed.	Classes resume at 7:50 a.m.
October 26	Fri.	Last day to drop a course at the 500 or 600 level without a grade.
October 26	Fri.	<i>Deadline for submission of theses to the Graduate School in final form as approved by advisory committees by candidates for master's and doctoral degrees in December, 1984. Last day for unconditional pass on final oral examinations by candidates for master's degrees not requiring theses.</i>
November 21	Wed.	Thanksgiving vacation begins at 1 p.m.
November 26	Mon.	Classes resume at 7:50 a.m.
December 7	Fri.	Last day of classes.
December 10-18	Mon.-Tues.	Final examinations.

SPRING SEMESTER, 1985

January 7	Mon.	Registration day.
January 8	Tues.	Change day (late registration, drop/add).
January 9	Wed.	First day of classes.
January 23	Wed.	Last day to add a course; last day to withdraw or drop a course with a refund.
February 6	Wed.	Last day to drop a course at the 400 level or below without a grade.
March 1	Fri.	Mid-semester reports due; spring vacation begins at 10 p.m.
March 11	Mon.	Classes resume at 7:50 a.m.
March 15	Fri.	Last day to drop a course at the 500 or 600 level without a grade.
March 15	Fri.	<i>Deadline for submission of theses to the Graduate School in final form as approved by advisory committees by candidates for master's and doctoral degrees in May, 1985. Last day for unconditional pass on final oral examinations by candidates for master's degrees not requiring theses.</i>
April 8	Mon.	Holiday.
April 26	Fri.	Last day of classes.
April 29-May 7	Mon.-Tues.	Final examinations.
May 11	Sat.	Commencement.

SUMMER SESSIONS, 1985*First Session*

May 21	Tues.	Registration day.
May 22	Wed.	First day of classes.
May 27	Mon.	Last day to add a course; last day to withdraw or drop a course with a refund.
May 31	Fri.	Last day to drop a course at the 400 level or below without a grade.
June 7	Fri.	Last day to drop a course at the 500 or 600 level without a grade.
June 25	Tues.	Last day of classes.
June 26	Wed.	Final examinations.

Second Session

July 1	Mon.	Registration day.
July 2	Tues.	First day of classes.
July 4	Thurs.	Holiday
July 8	Mon.	Last day to add a course; last day to withdraw or drop a course with a refund.
July 9	Tues.	<i>Deadline for submission of theses to the Graduate School in final form as approved by advisory committees by candidates for master's and doctoral degrees in August, 1985. Last day for unconditional pass on final oral examinations by candidates for master's degrees not requiring theses.</i>
July 12	Fri.	Last day to drop a course at the 400 level or below without a grade.
July 19	Fri.	Last day to drop a course at the 500 or 600 level without a grade.
August 6	Tues.	Last day of classes.
August 7	Wed.	Final examinations.

FALL SEMESTER, 1985

August 22	Thurs.	Registration day.
August 23	Fri.	Change day (late registration, drop/add).
August 26	Mon.	First day of classes.
September 2	Mon.	Holiday.
September 9	Mon.	Last day to add a course; last day to withdraw or drop a course with a refund.
September 23	Mon.	Last day to drop a course at the 400 level or below without a grade.
October 11	Fri.	Mid-semester reports due; fall vacation begins at 10 p.m.
October 16	Wed.	Classes resume at 7:50 a.m.

October 25	Fri.	Last day to drop a course at the 500 or 600 level without a grade.
October 25	Fri.	<i>Deadline for submission of theses to the Graduate School in final form as approved by advisory committees by candidates for master's and doctoral degrees in December, 1985. Last day for unconditional pass on final oral examinations by candidates for master's degrees not requiring theses.</i>
November 20	Wed.	Thanksgiving vacation begins at 1 p.m.
November 25	Mon.	Classes resume at 7:50 a.m.
December 6	Fri.	Last day of classes.
December 9-17	Mon.-Tues.	Final examinations.

SPRING SEMESTER, 1986

January 6	Mon.	Registration day.
January 7	Tues.	Change day (late registration, drop/add).
January 8	Wed.	First day of classes.
January 22	Wed.	Last day to add a course; last day to withdraw or drop a course with a refund.
February 5	Wed.	Last day to drop a course at the 400 level or below without a grade.
February 28	Fri.	Mid-semester reports due; spring vacation begins at 10 p.m.
March 10	Mon.	Classes resume at 7:50 a.m.
March 14	Fri.	Last day to drop a course at the 500 or 600 level without a grade.
March 14	Fri.	<i>Deadline for submission of theses to the Graduate School in final form as approved by advisory committees by candidates for master's and doctoral degrees in May, 1986. Last day for unconditional pass on final oral examinations by candidates for master's degrees not requiring theses.</i>
March 31	Mon.	Holiday.
April 25	Fri.	Last day of classes.
April 28-May 6	Mon.-Tues.	Final examinations.
May 10	Sat.	Commencement.

SUMMER SESSIONS, 1986

First Session

May 20	Tues.	Registration day.
May 21	Wed.	First day of classes.
May 26	Mon.	Last day to add a course; last day to withdraw or drop a course with a refund.

May 30	Fri.	Last day to drop a course at the 400 level or below without a grade.
June 6	Fri.	Last day to drop a course at the 500 or 600 level without a grade.
June 24	Tues.	Last day of classes.
June 25	Wed.	Final examinations.

Second Session

July 1	Tues.	Registration day.
July 2	Wed.	First day of classes.
July 4	Fri.	Holiday.
July 8	Tues.	Last day to add a course; last day to withdraw or drop a course with a refund.
July 9	Wed.	<i>Deadline for submission of theses to the Graduate School in final form as approved by advisory committees by candidates for master's and doctoral degrees in August, 1986. Last day for unconditional pass on final oral examinations by candidates for master's degrees not requiring theses.</i>
July 12	Mon.	Last day to drop a course at the 400 level or below without a grade.
July 19	Thurs.	Last day to drop a course at the 500 or 600 level without a grade.
August 6	Wed.	Last day of classes.
August 7	Thurs.	Final examinations.







NORTH CAROLINA STATE UNIVERSITY

North Carolina State University is one of the nation's major public universities—large, complex, national and international in scope, and a leader in education and research. It ranks among the top universities in the nation and shares the distinctive character of Land-Grant state universities nationally—broad academic offerings, extensive public service, national and international activities, and large-scale extension and research programs.

North Carolina State University is committed to equality of educational opportunity and does not discriminate against applicants, students, or employees based on race, color, national origin, religion, sex, age or handicap. Moreover, N. C. State University is open to people of all races and actively seeks to promote racial integration by recruiting and enrolling a larger number of black students.

N. C. State's rich and varied academic program is comprised of 94 undergraduate degree programs spanning 87 fields of study, 100 master's degree programs spanning 72 fields of study and 47 doctoral degree programs. The University offers approximately 2,800 courses.

Research activities span a broad spectrum of about 700 scientific, technological and scholarly endeavors with a budget of approximately \$60 million annually.

Extension work on a statewide basis in each of the 100 counties in North Carolina underscores the idea that the University's campus extends to the boundaries of the state. The diversity of these programs rivals the University's academic offerings and spans such fields as architecture, agriculture, animal science and veterinary medicine, business, education, engineering, environmental protection, forestry, industry, marine sciences, humanities and urban affairs.

The annual University budget is more than \$200 million and it has approximately 5,500 employees. There are more than 2,400 faculty and professional staff, including 1,337 graduate faculty and 200 adjunct faculty.

There are some 140 campus buildings with an estimated value of more than \$200 million.

The central campus in Raleigh is made up of some 623 acres with a 200-acre satellite School of Veterinary Medicine complex. The University also has some 88,000 acres on a statewide basis which includes one research and endowment forest of 78,000 acres. Near the main campus are research farms; biology and ecology sites; genetics, horticulture and floriculture nurseries; forests and other areas such as Carter-Finley Stadium, which comprise some 2,500 acres.

The University's total enrollment is more than 22,800 including approximately 16,250 undergraduate students, 3,300 graduate students, and 3,250 special students in various categories. The total student population is made up of approximately 8,200 women and 14,600 men including an estimated 2,450 black or other minority students. Students come to N. C. State from nearly every state in the nation and at least 88 foreign countries are represented by the nearly 800 international students.

The University is organized in nine schools and the Graduate School. The nine schools are Agriculture and Life Sciences, Design, Education, Engineering, Forest Resources, Humanities and Social Sciences, Physical and Mathematical Sciences, Textiles, and Veterinary Medicine. In addition, a complex of divisions and programs provides for a wide range of special programs in academic affairs, research and extension.

North Carolina State University is one of the three Research Triangle Universities along with Duke University and the University of North Carolina at Chapel Hill. In the 30-mile triangle formed by the three universities is the 5,500-acre Research Triangle Park; the Research Triangle Institute, a subsidiary of the three universities; and the Triangle Universities Computation Center, a central facility for the extensive computing centers of the institutions.

State is a member of the National Association of State Universities and Land-Grant Colleges. It is also a member of the American Council on Education, the College Entrance Examination Board, the Council of Graduate Schools in the United States, the National Commission on Accrediting, and the Southern Association of Colleges and Schools.

The University is accredited by national and regional accrediting agencies applicable to the University and its numerous professional fields.



THE GRADUATE SCHOOL

Graduate instruction was first offered at North Carolina State University in 1893, and the first doctoral degree was conferred in 1926. In the ensuing years, the Graduate School has grown steadily and now provides instruction and facilities for advanced study and research in the fields of agriculture and life sciences, design, education, engineering, forest resources, humanities and social sciences, physical and mathematical sciences and textiles. In 1982-83, the University granted 165 Doctor of Philosophy degrees, 30 Doctor of Education degrees and 552 master's degrees.

The Graduate School is currently composed of more than 1,330 graduate faculty members. Educated at major universities throughout the world and established both in advanced teaching and research, these scholars guide the University's 3,300 master's and doctoral students from all areas of the United States and some 88 other countries.

The faculty and students have available exceptional facilities, including libraries, laboratories, modern equipment and special research areas. Additionally, a cooperative agreement exists among the Graduate Schools of the University of North Carolina at Chapel Hill, the University of North Carolina at Greensboro, Duke University and North Carolina State University which increases the educational and research possibilities associated with each.

Graduate Student Association

The Graduate Student Association (GSA) is an academic, political and social organization composed of all graduate students and governed by duly elected officials and representatives from the departmental graduate student chapters. It is officially recognized by the university as the voice of the graduate students. The GSA President has full voting membership on the Graduate School Administrative Board and the GSA has the ability to broach responsible grievances to the administration on behalf of any graduate student.

Among the services that the GSA sponsors, one of its most viable academic programs is the Travel Fund. Through this fund graduate students may obtain funds to present original research work at professional meetings. The GSA also sponsors, along with the Alumni Association and the Academy of Outstanding Teachers, an annual awards ceremony to honor those teaching assistants of outstanding merit. In addition, the GSA, through its standing committees, sponsors various social events and provides support for departmental GSA chapters.

Generally, the GSA can provide assistance on most questions concerning graduate student life. Graduate students may contact GSA via their departmental representative or via the president of the Association whose telephone number can be obtained through the Graduate School. All graduate students are also invited to participate in the business meetings which are usually held on the fourth Monday of each month at 7:30 p.m. in the Student Senate Chambers.

The D. H. Hill Library

Library facilities at North Carolina State University include the main D. H. Hill Library and special libraries for the Schools of Design, Textiles, Curriculum Materials Center, Forest Resources and Veterinary Medicine. The collections, totaling more than 1,100,000 books and bound journals, 2,000,000 microforms, and 60,000 government publications, have been carefully assembled to serve the educational and research programs of the University.

The D. H. Hill Library contains particularly strong research holdings in the biological and physical sciences, in all fields of engineering, agriculture and forestry. The collection of books and journals in the humanities and social sciences is especially strong in English and American literature, sociology and economics.

The library's comprehensive collection of journals emphasizes the major teaching and research interests at State; approximately 8,300 journals are received regularly. A large collection of state and federal government publications further strengthens the library's research holdings. The D. H. Hill Library has been a depository for U. S. federal documents since 1924. The Library has a comprehensive collection of government research reports on microfiche including reports published by the Department of Energy (DOE) and its predecessor agencies, the Atomic Energy Commission (AEC) and the Energy Research and Development Administration (ERDA); also, the National Aeronautical and Space Administration (NASA), the Educational Resources Information Center (ERIC) and the National Technical Information Service (NTIS). The Library is an official U.S. Patent depository and has a complete collection of U.S. patents on microfilm from 1790 to date.

The Textiles Library, located in Nelson Textile Building, contains holdings in the fields of textiles and textile chemistry. It is regarded as one of the best textile libraries in the country. The School of Design Library, in Brooks Hall, has a fine collection of books, journals and slides in the areas of architecture, landscape architecture and product design. The Forest Resources Library, which contains a limited collection of specialized literature, is located in Biltmore Hall. The Veterinary Medical Library is a growing collection that serves the students and faculty of the School of Veterinary Medicine.

On-line computer-based literature searches are offered by the Library staff on over 60 data bases, including ERIC, BIOSIS, AGRICOLA (Bibliography of Agriculture) and Psychological Abstracts. Only direct costs are charged to the user.

As a further aid to graduate and faculty research, the library participates in an interlibrary loan program with the University of North Carolina at Chapel Hill, Duke University and all libraries in the Research Triangle. A truck, arriving at the University daily Monday through Friday, makes resources from these libraries available to State students and faculty.

Among the many services offered by the library are orientation tours for faculty and graduate students and also lectures on library use to all new students. Comprehensive reference service is available almost all the hours the library is open. A variety of microtext readers and printers in the library and an extensive microfilm collection provide access to much important research material. The Media Center is

equipped with audio and video equipment for group and individual viewing and listening. The Library has a growing collection of video and audio cassettes for individual and class use. One of the most widely used services in the library is the photocopy service. Coin-operated machines plus three machines operated by staff provide a wide variety of photocopy service, including copy from microfilm. Machines may be used all hours the library is open.

The Curriculum Materials Center, administered by the School of Education, is located in Poe Hall. The center maintains a collection of educational materials with particular emphasis on teaching methods, research, administration and psychology and includes films, filmstrips, slides, audio tapes, video cassettes and simulation games. A special collection of materials covering the areas of anthropology and third world countries is also maintained. Audiovisual equipment is available for previewing materials in the center and may be borrowed for use in Poe Hall classrooms. The center acquires each textbook adopted by the State Board of Education for secondary level subjects as well as other textbooks and reference materials.

Institutes

RESEARCH TRIANGLE

The unique "Research Triangle" in North Carolina has captured national and international attention in recent years. It is a complex of three major universities and a research park. The Triangle area has the highest total of Ph.D. scientists and engineers on a per capita basis in the nation. The universities have a subsidiary campus—the Research Triangle Institute—with \$45 million annual research revenue.

There are some 35 research organizations employing over 20,000 people in the 5,500-acre park. Some of the larger operations there include the permanent headquarters of the National Institute of Environmental Health Sciences and the Environmental Protection Agency. The Triangle Universities—Duke University, North Carolina State University and the University of North Carolina at Chapel Hill—have established a center for advanced studies there and the new National Humanities Center has located there. Faculty and graduate students from the universities work closely with research park activities and scientists there frequently hold adjunct appointments with the Triangle Universities.

INSTITUTE OF STATISTICS

The Institute of Statistics is composed of two sections, one at Raleigh and the other at Chapel Hill. At North Carolina State University, the Institute provides statistical consulting services to all branches of the institution, sponsors research in statistical theory and methodology and coordinates the teaching of statistics at the undergraduate and graduate levels. The instructional and other academic functions are performed by the Department of Statistics, which forms a part of the Institute.

WATER RESOURCES RESEARCH INSTITUTE

The Water Resources Research Institute is a unit of the University of North Carolina System and is located on the campus of North Carolina State University. The deans of the School of Engineering and School of Agriculture and Life Sciences, the Dean for Research at North Carolina State University and two faculty members from the University of North Carolina at Chapel Hill serve as a board of directors. The Institute was established to promote a multidisciplinary attack on water problems, to develop and support research in response to the needs of North Carolina, to encourage strengthened educational programs in water resources, to coordinate research and educational programs dealing with water resources and to provide a link between the state and federal water resources agencies and related interests in the University.

Research and educational activities are conducted through established departments and schools of the University System. All senior colleges and universities of North Carolina are eligible to participate in the Institute's research program. Basic support for the Institute's program is provided by the Office of Water Research and Technology, U.S. Department of the Interior, under the Water Research and Development Act of 1978 and appropriations from the State of North Carolina.

The Institute has sponsored a graduate minor in water resources which offers a strong water resources program with the major in any of the basic disciplines contributing to water resources planning, conservation, development and management. This capitalizes on the combined training resources of the Raleigh and Chapel Hill campuses of the University System and offers these in an organized way to graduate students seeking interdisciplinary training in this field. Additional information concerning the program is presented elsewhere in this catalog.

The Institute sponsors research and educational symposia and seminars, encourages the development of specialized training opportunities and provides a means for the continuing evaluation and strengthening of the University System's total water resources program.

Special Laboratories and Facilities

ACADEMIC COMPUTING FACILITIES

Centralized computing facilities for the University are located in the Hillsborough Building and at Triangle Universities Computation Center (TUCC) in the Research Triangle Park about fifteen miles from the campus. TUCC is owned by North Carolina State University, Duke University and the University of North Carolina at Chapel Hill and provides computing to over fifty research and educational institutions in North Carolina. Access to computing facilities at universities outside North Carolina is available to the University through TUCC via the Telenet Network.

Computing at TUCC is supplied by an IBM System 3081 Model D, an IBM System 70 Model 168 and two Hewlett-Packard Model 2000 minicomputers. The two large computer systems have a combined memory storage capacity of twenty-four million characters and a variety of peripheral and communications equipment.

Data are transmitted to and from TUCC via the University's Computer Communications System from many computing sites on the campus.

The main campus computing facility is an IBM 4341-11 with eight million characters of memory providing interactive computing services for students. There is also an IBM 3083 providing administrative data processing services for the campus. These systems are located at the Computing Center in the Hillsborough Building. A high-speed computer terminal facility and computer-to-computer communication with TUCC is provided by the Computing Center. Medium-speed terminals are located in the Schools of Engineering and Agriculture and Life Sciences. Low-speed interactive terminals are located throughout the campus.

A number of special purpose computing facilities also exist. The University Systems Analysis and Control Center (USACC) provides a centralized hardware and software facility for special-purpose interactive computing. Computers installed include a VAX 11/780, PDP 11/40, Charles River Systems and a number of microprocessors. Peripherals include image display and manipulation devices, plotters, printers, a colorigraphic camera system and digitizing tables. Software is composed of packages for remote sensing, image processing, time series analysis and computer graphics. Other facilities in most schools provide specialized educational and research computing for their students.

BIOLOGY FIELD LABORATORY

The Biology Field Laboratory is located eight miles from the University campus and comprises a 20-acre pond, 180 acres of extremely varied vegetation types and a modern laboratory building. The latter contains two laboratories, one for class use and another principally for research.

The many unique ecological situations found in this area make it ideal for use by advanced classes of most biological science departments. Likewise, the area is well adapted to a variety of research projects by faculty, graduate students and undergraduates because of its habitat diversity. The close proximity of the laboratory facility to the campus makes possible many types of behavioral, physiological, ecological, taxonomic and limnological studies that could be accomplished only with great difficulty at other locations.

COUNSELING LABORATORY

The Department of Counselor Education maintains a special counseling facility on the fifth floor of Poe Hall. The laboratory is staffed by professionally trained graduate students under the supervision of departmental faculty. The major emphasis is on helping a wide variety of persons who face educational, career and personal decisions through short-term counseling and advising. Occupational exploration and aptitude testing are often included. A minimal fee (\$10.00) is charged. Appointments are available during the fall and spring semesters.

DIAGNOSTIC TEACHING CLINIC

The Diagnostic Teaching Clinic is operated by the graduate program in special education within the School of Education for the purposes of providing graduate

students with opportunities to gain both observational and applied clinical experience in diagnosing and teaching handicapped children of all ages. The clinic accepts referral from local school systems and from nonpublic school agencies, and the students and staff evaluate the referred children, develop educational programs for them in conjunction with the referring agency and demonstrate teaching techniques for the benefit of those persons who will work with the children. This clinic is open during the day, late afternoon and early evening hours during the fall and spring semesters and is utilized by graduate students from several departments with allied curricula in education and psychology.

ELECTRON MICROSCOPE FACILITIES

There are three electron microscope facilities at N.C. State available to graduate students and faculty for research purposes. The School of Agriculture and Life Sciences (SALS) Center for Electron Microscopy is located in Gardner Hall, the Engineering Research Microscope Facility is in Burlington Engineering Labs and the Department of Wood and Paper Science Electron Microscopy Lab is in Biltmore Hall.

The SALS Electron Microscope Center has two scanning microscopes: an ETEC U-1 and a JEOL T-200 and four transmission electron microscopes: an Hitachi HS-8-B, an Hitachi HU-11-B, a JEOL 100-S and a Philips 400T-STEM. The Center also makes available all of the necessary biological preparatory equipment.

Formal instruction is provided through the biological sciences curriculum for transmission electron microscopy, scanning electron microscopy and ultramicrotomy. Advanced techniques are provided on an individual basis or through workshops.

The Engineering Research Microscope Facility is equipped with a new Hitachi model H-800 scanning transmission electron microscope and a JEOL model JSM-2 scanning electron microscope. Both are equipped with energy dispersive X-ray analysis systems.

The H-800 has a maximum operating potential of 200,000 volts and is suitable for examination of ceramic, metallurgical and textile materials. It is capable of operating in transmission, scanning and scanning transmission modes. It is equipped with an energy-dispersive X-ray system (TRACOR NORTHERN TN-2000) making it a fully capable analytical instrument.

The JSM-2 can be used alone or with its energy dispersive X-ray analysis system which makes it capable of qualitative and quantitative analysis of uniquely small amounts of materials (down to cubic microns). Full computer control of the system allows automated data collection and processing.

An electron probe analyzer (AMR/3) augments the X-ray analytical capabilities of these instruments by offering qualitative and quantitative analysis on the micron level with a wavelength dispersive detection system.

In addition, the ion probe microanalyzer (CAMECA IMS 3f) offers secondary ion mass spectrometer (SIMS) analysis with sub-micrometer lateral resolution and atomic layer depth resolution and a typical detection limit in the ppm to ppb range. Two primary ion sources (oxygen and cesium), an electron multiplier as well as a

digital imaging system make this instrument particularly suited for the characterization of engineering, electronic and biological materials.

The facility is completely equipped for specimen preparation in the physical sciences and offers instruction to graduate students on an individual basis.

The Department of Wood and Paper Science Microscopy Lab is equipped with a Siemens Elmskop-1A transmission electron microscope as well as all other equipment necessary for the preparation and study of specimens. Instruction for graduate students engaged in research is on an individual need basis.

HIGHLANDS BIOLOGICAL STATION

North Carolina State University is an institutional member of the Highlands Biological Foundation which provides support for the Highlands Biological Station of the University of North Carolina. This is an inland biological field station located at Highlands, North Carolina. The town of Highlands is in the heart of the Southern Appalachians at an elevation of 3,823 feet. The area has an extremely diverse biota and the highest rainfall in the eastern United States.

Facilities are available throughout the year for pre- and post-doctoral research in botany, zoology, soils and geology. The laboratory building with research rooms and cubicles and the library are well equipped for field-oriented research. Also, five cottages and a dining hall are located on the edge of a six-acre lake. In addition to 16 acres surrounding the lake, the station owns several tracts of undisturbed forested land available for research. Research grants available through the Station provide stipends for room, board and research expenses.

NUCLEAR SERVICE FACILITIES

Specialized nuclear service facilities are available to the University faculty, students and industry. The purpose of these facilities is to further the use of nuclear energy in engineering research and in scientific and public service programs. The facilities include: a 1 megawatt steady-state and pulse, pool-type, research reactor (PULSTAR), with a variety of test facilities; intermediate level hot laboratories with hoods, junior caves and glove boxes; a neutron activation analysis and radioisotope laboratory; NaI and solid-state detectors; and counting and photographic rooms. The 50,000 sq. ft. Burlington Engineering Laboratories complex houses the Departments of Nuclear Engineering and Materials Engineering with their associated offices and laboratories. All of the facilities including the reactor are on the North Carolina State University campus.

ORGANIZATION FOR TROPICAL STUDIES

North Carolina State University shares with the University of North Carolina at Chapel Hill an institutional membership in the Organization for Tropical Studies (OTS), a consortium of North and Central American universities which maintains field research and teaching facilities in Costa Rica. Each year OTS sponsors courses in tropical biology that are open to NCSU graduate students with biological science backgrounds. These 8-week courses, offered in winter and summer, are taught in Costa Rica and make use of a network of field stations located throughout

the country. NCSU is an active participant in the OTS graduate education program, with an average attendance of two students per year in the tropical biology courses.

The OTS facilities in Costa Rica also provide a unique opportunity for tropical research by NCSU graduate students and faculty. The principal field station, located in the northeastern Atlantic lowlands, has excellent laboratory and housing facilities and provides access to a 3,500-acre tract owned by OTS; 65% of this tract is undisturbed lowland tropical wet forest. Another station is located at mid-elevation in southeastern Costa Rica near the Panamanian border. OTS also utilizes various other sites, including a seasonally dry area in the northwestern part of the country and a high-elevation area at 10,000 feet in the Talamanca range. More information about OTS may be obtained from the campus representative, who can be contacted through the International Programs Office.

PESTICIDE RESIDUE RESEARCH LABORATORY

The Pesticide Residue Research Laboratory is a facility in the School of Agriculture and Life Sciences devoted to research on pesticide residues in animals, plants, soils, water and other entities of man's environment. Although the laboratory is administered through the Department of Entomology, it serves the total needs of the School in cooperative research projects requiring assistance on pesticide residue analysis.

The laboratory functions as a focal point for residue research involving inter-departmental cooperation, but faculty in the laboratory also conduct independent pesticide research on persistence and decomposition in soils and plants, absorption and translocation in plants, distribution in environment and contamination of streams, estuaries and ground water.

The laboratory is equipped with the latest analytical instruments. Graduate study can be undertaken in any aspect of pesticide residues either in the Pesticide Residue Research Laboratory or in one of the cooperating departments.

PSYCHOLOGY CLINIC AND LABORATORIES

The Department of Psychology operates a School Psychology Clinic located in Poe Hall. The clinic provides both a service to the public and training for school psychology graduate students. School-age child assessment and program development are the major services provided. Coordination of internships and practica is also administered through this facility.

Each graduate program in psychology also has laboratory facilities, either independently or shared. Thus, the experimental psychology program has laboratories for neuropsychology, auditory and visual perception, cognition and operant behavior. There is also a training and development laboratory as well as facilities for ergonomics, applied developmental educational psychology, human resource development, industrial/organizational and vocational psychology and social psychology. The latter facilities include one-way viewing rooms with appropriate audio and video recording equipment.

REPRODUCTIVE PHYSIOLOGY RESEARCH LABORATORY

The Reproductive Physiology Research Laboratory administered through the Department of Animal Science includes environmental control rooms designed to provide constant levels of air temperature, humidity and light for animals involved in studies on reproduction. Facilities and equipment are available for surgery, in vitro growth of embryos, isotope labeling in embryo metabolism and transfer of embryos between females.

Support for research at both the master's and the doctoral levels is available. Students may elect a comparative approach to a specific problem in mammalian reproduction, working with several species, or they may choose to work with a single species. Generally students select a problem associated with the identification of factors influencing early prenatal development, the endocrine control of ovarian function or some aspect of elucidation and control of aberrations in mammalian reproduction.

Cooperative research is possible between the laboratory, the School of Veterinary Medicine and the Medical School or the Environmental Health Sciences Center at the University of North Carolina at Chapel Hill for those students desiring a broader training in the general area of reproductive physiology.

Students whose work is concentrated in reproductive physiology can major in either animal science or physiology with a minor in related disciplines.

SOUTHEASTERN PLANT ENVIRONMENTAL LABORATORIES— PHYTOTRON

The Southeastern Plant Environment Laboratory, often referred to as the North Carolina State University Phytotron, is especially designed for research dealing with the response of plants and microorganisms to their environment. A high degree of environmental control makes possible simulation of a wide range of climates found in tropical, temperate and northern zones.

Research in the Phytotron deals with all phases of plant biology. Although the majority of the studies are conducted with agricultural crop species, the Phytotron can accommodate ecological investigations, plant biology problems of the space program, experimental taxonomy and air pollution studies as well as basic physiological and biochemical research.

The Phytotron facility is available to the resident research staff, participants in graduate research programs of North Carolina State University and to domestic and foreign visiting scientists.

TRIANGLE UNIVERSITIES NUCLEAR LABORATORY

TUNL is a laboratory for nuclear structure research. Located on the campus of Duke University in Durham the laboratory is staffed by faculty members and graduate students in the Departments of Physics of Duke University, the University of North Carolina at Chapel Hill and North Carolina State University. Particle accelerators are used to bombard target nuclei with an assortment of ions of accurately controlled energy spread spin orientation. The accelerators are a 15 MeV tandem Van de Graaff generator into which negative ions are injected by a 15 MeV

AVG cyclotron and a 3 MeV and a 4 MeV Van de Graaff generator. Polarized and pulsed beams are available as well as a new polarized target. On-line computers are used for data collection and analysis.

Personnel from NCSU are partners in the maintenance and operation of the laboratory. There is extensive collaboration with personnel from the other two participating universities. This laboratory, which began operation in 1968, was the first to combine a cyclotron and tandem Van de Graaff generator—the “Cyclo-Graaff.”

Special Program

RESEARCH PROGRAM AT THE OAK RIDGE ASSOCIATED UNIVERSITIES

North Carolina State University is one of the sponsoring institutions of the Oak Ridge Associated Universities at Oak Ridge, Tennessee. Through this cooperative association, North Carolina State's graduate research program has at its disposal the facilities and research staff at Oak Ridge National Laboratory. Extensive research programs are underway there on physical and biological effects of radiation, radioisotope utilization, materials microstructure and many other areas of materials and nuclear science and engineering. When master's and doctoral candidates have completed their resident work, it may be possible, by special arrangement, for them to do their thesis research at Oak Ridge National Laboratory. In addition, it is possible for the staff members of this University to go to Oak Ridge for advanced study in their particular fields.



Nondiscrimination Statement

North Carolina State University is dedicated to equality of opportunity within its community. Accordingly, North Carolina State University does not practice or condone discrimination, in any form, against students, employees or applicants on the grounds of race, color, national origin, religion, sex, age or handicap. North Carolina State University commits itself to positive action to secure equal opportunity regardless of those characteristics.

North Carolina State University supports the protection available to members of its community under all applicable Federal laws, including Titles VI and VII of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, Sections 799A and 845 of the Public Health Service Act, the Equal Pay and Age Discrimination Acts, the Rehabilitation Act of 1973, the Vietnam Veterans Readjustment Assistance Act of 1974, and Executive Order 11246. For information concerning these provisions, contact:

Dr. Lawrence M. Clark
Associate Provost & Affirmative Action Officer
201 Holladay Hall
P. O. Box 7101
North Carolina State University
Raleigh, North Carolina 27695-7101
Phone: 919/737-3409

UNIVERSITY PATENT POLICY

The University Patent Policy specifies that any invention made by a graduate student with the direct or indirect support of the University shall be assigned to the University. A graduate student who is an inventor will receive a share of the royalties from the invention as specified in the University policy.

GENERAL INFORMATION

Application

Applications for admission must be accompanied by the following: two official transcripts from all colleges and universities previously attended, references from at least three people who know of the student's academic record and potential for graduate study, a non-refundable application fee of \$15 and, in some cases, an official statement of the student's Graduate Record Examination scores.* Application and reference forms may be obtained by writing or visiting the Dean of the Graduate School, P. O. Box 5335, 104 Peele Hall, North Carolina State University, Raleigh, N. C. 27650. When completed, all application materials should be returned according to instructions. Application is made for a specific degree program and date of enrollment (see "Admission").

International Students

Students whose native language is other than English must submit TOEFL (Test of English as a Foreign Language) scores as evidence of ability to use English at a level of competence sufficient for graduate work. A minimum TOEFL score of 500 and section scores of no less than 45 are required prior to admission. (Minimum score subject to change). The test date must be within 12 months of the date of application. All international students must be cleared by the Department of Foreign Languages and Literatures during the first two weeks of their initial semester in residence and may be required to take additional course work in English. In addition, the international applicant must provide the University with verification that the required funds are available to support the proposed program of advanced study. Foreign nationals in the United States at the time application is made must also provide information regarding their current visa status. The University provides special forms to be used by the applicant in supplying this information.

Admission

The procedures followed in evaluating an applicant's potential for success in graduate work and the criteria used for admissions decisions vary according to departments and schools and reflect an evaluation of the applicant's potential to

* The following departments and programs will not act on applications unless accompanied by GRE scores: biochemistry, biomathematics, botany, computer studies, crop science, ecology, education (all programs with the exception of the master's program in adult and community college education; psychology also requires the Advanced Test and Miller Analogies), electrical and computer engineering, English, entomology, forestry, history, industrial engineering, marine, earth and atmospheric sciences, mathematics, nutrition, plant pathology, political science and public administration, sociology, toxicology and zoology.

Many departments, although not normally requiring GRE scores, may in special instances require their submission as additional information to be used in making a judgment of the student's potential for success in a graduate program.

Information regarding the Graduate Record Examination and registration forms may be obtained from the Educational Testing Service, Box 955, Princeton, New Jersey 08540 or Box 1502, Berkeley, California 94701.

engage in graduate work and the capability of the individual departments to accommodate additional students. Most departments consider applications as they arrive, while others accumulate applications and make recommendations on admission at certain times during the year. Generally, requests for admission are considered by departmental admissions committees which forward the departmental recommendations to the Dean of the Graduate School.

Students are admitted to full or provisional status in a specific degree program. Admission is granted for a specific semester or summer term. Any change in the admission date must be requested in writing and approved by the department and Graduate School. Once the requirements for that degree program have been completed, no further registration as a graduate student will be permitted unless admission to a new graduate classification has been formally approved. Students with special objectives may request admission as "Graduate-Unclassified Students" (see below) or register in the "Post-Baccalaureate Studies" program (see next page) through the Division of Continuing Education.

FULL GRADUATE STANDING

To be considered for admission in full graduate standing, an applicant must have a baccalaureate degree from a college or university recognized as standard by a regional or general accrediting agency and must have at least a "B" average in the undergraduate major.

PROVISIONAL ADMISSION

1. Provisional admission may be granted to applicants with bachelor's degrees from accredited institutions who lack undergraduate work considered essential for graduate study in a major field. Course work, without graduate credit, will be required to make up such deficiencies before admission to full status can be granted.

2. Applicants with bachelor's degrees from nonaccredited institutions may be granted provisional admission when their academic records warrant this status. Additional course work will be required of such students when deficiencies in previous training are apparent.

3. Students with bachelor's degrees from accredited institutions whose scholastic records are below the standards for admission to full graduate standing may be admitted provisionally when unavoidable, extenuating circumstances affected their undergraduate averages or when progressive improvement in their undergraduate work warrants provisional admission.

A graduate student admitted to provisional status is not eligible for appointment to an assistantship or fellowship. Full graduate standing is granted when the deficiencies responsible for the provisional status are corrected, provided the student has maintained a satisfactory academic record (3.0 Grade Point Average) on all course work taken in a graduate classification. A change from provisional status

to full graduate standing is effected only upon the recommendation of the department in which the student is seeking the degree.

GRADUATE-UNCLASSIFIED STUDENTS

The Graduate-Unclassified status is a temporary classification and students admitted to this status are not candidates for degrees. They may take courses for graduate credit but may not apply more than 10 credits earned while in this status to any program leading to an advanced degree at this institution. Unclassified graduate students are expected to meet the same admissions requirements that apply to graduate students in full standing. Any individual having an interest in applying for admission as a Graduate-Unclassified Student should correspond with the Graduate Dean describing his or her particular interests and objectives prior to making application.

POST-BACCALAUREATE STUDIES (PBS)

The Post-Baccalaureate Studies (PBS) classification is designed for U. S. citizens who wish to undertake academic work beyond the baccalaureate degree but who are not currently admitted to a degree program. This classification is not open to foreign nationals with the exception of the spouse of a regularly enrolled NCSU student. In special cases where students are sponsored by an agency of the U. S. government for specialized, non-degree study, approval may be given by the Graduate School for registration in the Post-Baccalaureate Studies classification. The following policies apply to students who wish to register for PBS:

1. All must have baccalaureate degrees from accredited institutions of higher education.
2. Registration is through the Division of Continuing Education; the submission of transcripts is not required. PBS students may register for course work at any level. Registration for regular course credit (A, B, C, D, NC or S, U) at the 500- and 600-levels is limited to a total of nine semester hours. (Hours completed in the "Graduate Special" classification which was discontinued at the end of the 1974 fall semester or in any other graduate classification or any hours approved for graduate credit while classified as a senior or unclassified undergraduate at North Carolina State University will be included in the nine hours permitted.) PBS students may register for further course work at the 500- and 600-levels for "Credit Only."
3. Registration is normally limited to a maximum of two courses per semester. Individuals who are employed full-time should limit their PBS registrations to one course per semester.
4. The PBS classification carries with it no implication that the student will be admitted to the Graduate School in any degree classification.
5. A PBS student who is in due course admitted initially to a graduate degree program may request that a maximum of nine hours of course work at the 400-level or above taken for regular course credit (A, B, C, D, NC or S, U) be considered for graduate degree credit. No course taken for "Credit Only" (which is graded "CS" or "CU") may be considered for graduate degree credit.

All course work accepted for degree credit must be approved by the student's advisory committee as being germane to the program. Requests for degree credit for courses completed in the PBS classification are considered after admission to a graduate degree program when the student's Plan of Graduate Work is filed with the Graduate School.

6. PBS students are expected to familiarize themselves with Graduate School policies and to seek further advice or clarification as needed.

SCHOOL OF ENGINEERING PROFESSIONAL DEGREE PROGRAM

Professional degree students are admitted as undergraduate students, are classified as "PR" students and are subject to rules and regulations as established and administered by the Dean of the School of Engineering.

A professional degree student who is subsequently admitted to the Graduate School may, with the approval of the master's advisory committee, the major department and the Graduate School, transfer a maximum of nine hours of credit for courses in which a grade of "B" or higher was received.

Certificate Renewal

Public school personnel who are primarily interested in "certification credit" may enroll in the PBS program through the Division of Continuing Education without forwarding transcripts of previous work to the Graduate School. In such cases, the School of Education will be responsible for assessing the adequacy of the applicant's qualifications for enrollment in the course(s) concerned.

Registration and Records

The Office of Registration and Records must have authorization from the Dean of the Graduate School before a graduate student in any classification will be permitted to register for classes. This authorization will be sent to the Office of Registration and Records at the time the student is notified of acceptance for graduate study. All students attending classes must be registered for credit or audit.

Records of progress are kept by this institution on veteran and non-veteran students alike. Progress records are furnished the students, veterans and non-veterans alike, at the end of each scheduled school term.

All students who are using University facilities must be registered. Students who are not in residence and do not require University facilities to complete their degree requirements are not required to be registered in the term the degree is awarded. The chair of the student's advisory committee is responsible for determining the status of the student who is not in residence with respect to use of University resources in the term of graduation and whether or not registration is required.

MEDICAL HISTORY

All graduate students admitted to a degree program are required to submit a report of medical history prior to completing their initial registration.

INTERINSTITUTIONAL REGISTRATION

North Carolina State University participates in an Interinstitutional Registration program with the University of North Carolina at Chapel Hill, the University of North Carolina at Greensboro and Duke University. Under this agreement, graduate students enrolled at this university may undertake course work on these campuses upon the recommendation of their advisory committees.

Even though taking a course on another campus, the graduate student is exclusively under the administrative direction of the North Carolina State University Graduate School. Enrollment for courses on other campuses will take place on this campus, using special forms obtained from the Office of Registration and Records. The Graduate School shall consider courses taken on other campuses as a part of the student's normal load, and the billing for such work will be through the Office of Finance and Business. The procedures followed in the summer sessions are somewhat different; detailed instructions are available in the Office of Registration and Records.

When the grading system on the campus being visited is different from the North Carolina State University system, grades received under Interinstitutional Registration will be converted to the North Carolina State University system. "H," "P," "L" and "F" grades earned at the University of North Carolina at Chapel Hill and "E," "G," "S" and "F" grades earned at Duke University will be converted to "A," "B," "C" and "NC" grades, respectively.

COURSE LOAD

A full-time graduate course load is 9 to 15 credits per semester (including audits) and 6 credits per summer session (including audits). Audits in subjects in which the student has no previous experience will be evaluated at full credit value in determining course load. Audits taken as repetition of work previously accomplished are considered at one half of their value in calculating course loads. With the single exception of foreign language audits, all audit registrations must fall within the range of maximum permissible course loads.

Foreign students on F-1 and J-1 visas are required by the Immigration and Naturalization Service to carry a full-time course of study to remain in status.

Graduate students holding assistantships are restricted to the following maximum semester course loads: full time, 3 hours; three-quarters time, 6 hours; one-half time, 9 hours; one-quarter time, 12 hours. External employment obligations of students on assistantships plus their assistantship obligations should not exceed these limits. Additionally, graduate assistants are limited to the following maximum totals of credit hours over the duration of their appointments:

<i>Service Obligation</i>	<i>Length of Appointment</i>	<i>Maximum Credit Hours</i>
Full time	9 months	6
Full time	12 months	9
3/4 time	9 months	12
3/4 time	12 months	16

1/2 time	9 months	18
1/2 time	12 months	24
1/4 time	9 months	24
1/4 time	12 months	30

SENIORS

A member of the senior class may, with prior approval of the Dean of the Graduate School, register for graduate credit in courses at the 400- and 500-levels as long as the combined graduate and undergraduate credit load is not more than 15 hours. Seniors with an accumulated grade point average of 3.2 or better in their major may enroll for a combined graduate and undergraduate credit load of 18 hours upon the recommendation of the student's advisor and approval by the department and the Graduate School. No more than six hours of graduate credit may be accumulated by a senior, and those graduate credits may not be applied toward the requirements for a baccalaureate degree. Courses at the 600-level are not ordinarily open to undergraduates, although occasional exceptions are made for senior honor students.

Seniors desiring to take courses for graduate credit should contact their major advisers who will forward appropriate requests to the Graduate Dean for approval.

AUDITS

Students wishing to audit courses must have the approval of their advisers and of the instructors teaching the courses. While auditors receive no course credit, they are expected to attend class regularly. The degree to which auditors must participate in class beyond regular attendance is optional with the instructors; any such requirements should be clearly explained to the auditors in writing at the beginning of the semester. An instructor who feels that an auditor has failed to fulfill the stipulated requirements is justified in marking "NR" (no recognition given for audit) on the grade report roll.

Tuition and Fees

A statement of tuition and fees is mailed to each preregistered student approximately 20 to 30 days before the beginning of any term. The statement must be returned with full payment or complete financial assistance information by the due date appearing on the statement. Normally the due date is approximately two weeks before classes begin. Non-preregistered students are required to pay their tuition and fees at registration.

SEMESTER RATE SCHEDULE—1983-84 ACADEMIC YEAR**RESIDENTS OF NORTH CAROLINA***

<i>Hours</i>	<i>Tuition</i>	<i>Required Fees</i>	<i>Total</i>
0-Thesis	\$110	\$ 12	\$122
0-2	60	41	101
3-5	120	41	161
6-8	180	82	262
9+	240	123	363

NONRESIDENTS**

<i>Hours</i>	<i>Tuition</i>	<i>Required Fees</i>	<i>Total</i>
0-Thesis	\$ 252	\$ 12	\$ 264
0-2	355	41	396
3-5	711	41	752
6-8	1,066	82	1,148
9+	1,421	123	1,544

SUMMER SESSION RATE SCHEDULE—1984**RESIDENTS OF NORTH CAROLINA****NONRESIDENTS**

<i>Hours</i>	<i>Tuition and Required Fees</i>	<i>Tuition and Required Fees</i>
0-Thesis	\$ 61	\$ 132
1-5	138	414
6	226	779

SPECIAL REGISTRATION AND FEES—1983-84 ACADEMIC YEAR

****Summer Research [GR 596S (master's candidates) or GR 696S (doctoral candidates)]*

For graduate students whose programs of work specify no formal course work during a summer session and who will be devoting full time to thesis research.

****Examination Only [GR 597 (master's candidates)]*

For graduate students in master's programs not requiring a thesis who have completed all requirements except the final oral examination by the beginning of the term in which the degree is to be awarded.

****Thesis Preparation Only [GR 598 (master's candidates) or GR 698 (doctoral candidates)]*

For graduate students who have completed all course work, research and residence requirements and who are writing a thesis or dissertation.

*For definition of in-state and out-of-state rates, see pp. 34-36.

**Under certain conditions, nonresident students who have been offered an assistantship, traineeship or fellowship may be eligible for reduced tuition rates.

***Assessed the 0-Thesis rate.

*****Dissertation Research [GR 697 (doctoral candidates)]**

For doctoral students who have scheduled no formal course work during a given term, who have passed the preliminary examinations, who have completed at least six hours of departmental research on the doctoral program and who are devoting full time to the dissertation. Students so registered are full-time; the course carries no credit hour designation.

Audits

During semester when registered and	One audit free, each additional
paying for other course work	audit same cost as for credit

During semester when not registered	
for other course work	Same cost as for credit

During any summer session	Same cost as for credit
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<i>Full-time Faculty or Staff</i>	\$ 7
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<i>Microfilming Doctoral Dissertation</i>	\$37
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Office of International Visitors

A special administrative management fee of \$200 per semester and \$100 per summer session is required from a contracting agency sponsoring international students who are programmed and advised by the University's Office of International Visitors.

(ALL CHARGES ARE SUBJECT TO CHANGE WITHOUT NOTICE)

FULL-TIME FACULTY AND EMPLOYEES

Full-time faculty of instructor rank and above and other full-time employees of the University who hold membership in the Teachers' and State Employees' Retirement System may register for credit or as auditors with free tuition privileges for one course in any academic term at any campus of the University of North Carolina. Free tuition privileges do not apply during the summer. Each applicant for free tuition must submit through regular channels a form provided by the University.

REFUND OF TUITION AND FEES

A student who officially withdraws from school during the first two weeks of a semester or by the end of the fourth day of a summer session will receive a tuition and fees refund of the full amount paid less a registration fee. The withheld fee amounts to \$15 the first week and \$25 the second week. After the two week period, no refund will be made.

In some instances, circumstances justify the waiving of rules regarding refunds. An example might be withdrawal because of sickness. Students have the privilege of appeal to the Fee Appeals Committee when they feel special consideration is

***Assessed the O-Thesis rate.

merited. Applications for such appeals may be obtained from the University Cashier and Student Accounts Office, 2 Peele Hall.

RESIDENCE STATUS FOR TUITION PURPOSES

The basis for determining the appropriate tuition charge rests upon whether a student is a resident or a nonresident for tuition purposes. Each student must make a statement as to the length of his or her residence in North Carolina with assessment by the institution of that statement to be conditioned by the following:

Residence—To qualify as a resident for tuition purposes, a person must become a legal resident and remain a legal resident for at least twelve months immediately prior to classification. Thus, there is a distinction between legal residence and residence for tuition purposes. Furthermore, twelve months' legal residence means more than simple abode in North Carolina. In particular, it means maintaining a domicile (permanent home of indefinite duration) as opposed to "maintaining a mere temporary residence or abode incident to enrollment in an institution of higher education." The burden of establishing facts which justify classification of a student as a resident entitled to in-state tuition rates is on the applicant for each classification, who must show his or her entitlement by the preponderance (the greater part) of the residentiary information.

Initiative—Being classified a resident for tuition purposes is contingent on the student's seeking such status and providing all information that the institution may require in making the determination.

Parents' Domicile—If an individual, irrespective of age, has living parent(s) or court-appointed guardian of the person, the domicile of such parent(s) or guardian is, prima facie, the domicile of the individual; but this prima facie evidence of the individual's domicile may or may not be sustained by other information. Further, nondomiciliary status of parents is not deemed prima facie evidence of the applicant child's status if the applicant has lived (though not necessarily legally resided) in North Carolina for the five years preceding enrollment or re-registration.

Effect of Marriage—Marriage alone does not prevent a person from becoming or continuing to be a resident for tuition purposes, nor does marriage in any circumstance insure that a person will become or continue to be a resident for tuition purposes. Marriage and the legal residence of one's spouse are, however, relevant information in determining residentiary intent. Furthermore, if both a husband and his wife are legal residents of North Carolina and if one of them has been a legal resident longer than the other, then the longer duration may be claimed by either spouse in meeting the twelve-month requirement for in-state tuition status.

Military Personnel—A North Carolinian who serves outside the State in the armed forces does not lose North Carolina domicile simply by reason of such service, and students from the military may prove retention of establishment of residence by reference, as in other cases, to residentiary acts accompanied by residentiary intent.

Grace Period—If a person (1) has been a bona fide legal resident, (2) has consequently been classified a resident for tuition purposes and (3) has subsequently lost North Carolina legal residence while enrolled at a public institution of higher education, that person may continue to enjoy the in-state tuition rate for a grace

period of twelve months measured from the date on which North Carolina legal residence was lost. If the twelve months end during an academic term for which the person is enrolled at a State institution of higher education, the grace period extends, in addition, to the end of that term. The fact of marriage to one who continues domiciled outside North Carolina does not by itself cause loss of legal residence, marking the beginning of the grace period.

Minors—Minors (persons under 18 years of age) usually have the domicile of their parents, but certain special cases are recognized by the residence classification statute in determining residence for tuition purposes.

(a) If a minor's parents live apart, the minor's domicile is deemed to be North Carolina for the time period(s) that either parent, as a North Carolina legal resident, may claim and does claim the minor as a tax dependent, even if other law or judicial act assigns the minor's domicile outside North Carolina. A minor thus deemed to be a legal resident will not, upon achieving majority before enrolling at an institution of higher education, lose North Carolina legal residence if that person (1) upon becoming an adult "acts, to the extent that the person's degree of actual emancipation permits, in a manner consistent with bona fide legal residence in North Carolina" and (2) "begins enrollment at an institution of higher education not later than the fall academic term next following completion of education prerequisite to admission at such institution."

(b) If a Minor has lived for five or more consecutive years with relatives (other than parents) who are domiciled in North Carolina and if the relatives have functioned during this time as if they were personal guardians, the minor will be deemed a resident for tuition purposes and term commencing immediately after at least five years in which these circumstances have existed. If under this consideration a minor is deemed to be a resident for tuition purposes immediately prior to his or her eighteenth birthday, that person on achieving majority will be deemed a legal resident of North Carolina of at least 12 months' duration. This provision acts to confer in-state tuition status even in the face of other provisions of law to the contrary; however, a person deemed a resident of 12 months' duration pursuant to this provision continues to be a legal resident of the State only so long as he or she does not abandon North Carolina domicile.

Lost but Regained Domicile—If a student ceases enrollment at or graduates from an institution of higher education while classified a resident for tuition purposes and then both abandons and reacquires North Carolina domicile within a 12-month period, that person, if he or she continues to maintain the reacquired domicile into re-enrollment at an institution of higher education, may re-enroll at the in-state tuition rate without having to meet the usual 12-month durational requirement. However, any one person may receive the benefit of this provision only once.

Change of Status—A student admitted to initial enrollment in an institution (or permitted to re-enroll following an absence from the institutional program which involved a formal withdrawal from enrollment) must be classified by the admitting institution either as a resident or as a non-resident for tuition purposes prior to actual enrollment. A residence status classification once assigned (and finalized pursuant to any appeal properly taken) may be changed thereafter (with

corresponding change in billing rates) only at intervals corresponding with the established primary divisions of the academic year.

Transfer Students—When a student transfers from one North Carolina public institution of higher education to another, he or she is treated as a new student by the institution to which he or she is transferring and must be assigned an initial residence status classification for tuition purposes.

Law—The controlling North Carolina statute concerning residence status classification for tuition purposes is G.S. 116-143.1. Copies of the applicable law and/or implementing regulations are available for inspection in the Office of Undergraduate Admissions, 112 Peele Hall.

To initiate a review of a residence status classification, a student must submit a Residence-and-Tuition Status Application to the Undergraduate Admissions Office. Questions about residency should be directed to that office.

CLASSIFICATION PROCEDURES

A. *Initial Classification*—A student admitted to initial enrollment in an institution (or permitted to re-enroll following an absence from the institutional program which involved a formal withdrawal from enrollment) shall be classified by the admitting institution either as a resident or as a nonresident, for tuition purposes, prior to actual matriculation. Particular officials or offices of the institution shall be designated to evaluate all such initial classification cases and to assign an appropriate classification consistent with the requirements of State law and the provisions of this manual. Basic data on which such assignment shall be based shall be collected in accordance with the common informational form prescribed in Appendix B of Residence Manual, 1973, as revised 7/74 and 7/75, NCSU; additional data or documentation deemed essential to a reliable determination may be elicited from the student, as deemed appropriate by the responsible official or office.

B. *Subsequent Classification Inquiries: Reclassification*—A residential classification once assigned (and confirmed pursuant to any appellate process invoked) may be changed thereafter only at intervals corresponding with the established primary divisions of the academic calendar of the institution, viz., at the beginning of a semester, quarter, or otherwise denominated basic interval of the academic calendar. No change in residential status for tuition purposes (and thus no change in applicable billing rates) shall be effected during such a semester, quarter, or term, with resulting increases or decreases in the tuition obligation on a pro rata basis for a portion of such semester, quarter or term.

The institution shall provide to each student at the time of and in connection with the transmission to him or her of each periodic bill for tuition charges a notice of the circumstances under which and the time at which a change in classification may occur. The notice shall be of the type prescribed in Appendix C of the Residence Manual, July, 1973, as revised 7/74 and 7/75, NCSU.

Fellowships and Graduate Assistantships

Graduate students may receive financial support through fellowships, traineeships and teaching or research assistantships sponsored by federal, state

and private agencies. Prospective students may request consideration for financial assistance by completing the appropriate sections of the admissions application form. Applicants for these awards should correspond directly with the department of major interest concerning the availability of awards and related information. Enrolled students should contact the major department. Prospective and enrolled graduate students are encouraged to apply for national, regional and foundation fellowships in addition to awards sponsored through the University.

The University offers approximately 1,000 assistantships each year. Stipend rates for teaching and research assistantships are competitive with other universities. For further information on the availability of assistantships, applicants should contact the program area of interest.

All awardees are responsible for tuition payments as determined by their residence status unless payment is specifically provided for by the terms of the fellowship or traineeship grant. Non-resident students appointed by the University to a fellowship, traineeship or assistantship may be considered for a special tuition rate. Further information may be obtained by contacting the Graduate School office or the department of major interest.

A graduate student must be in good academic standing (B or better average) to be eligible for appointment to an assistantship, fellowship or traineeship and must be registered in each semester in which the appointment is in effect.

SPONSORING AGENCIES

A partial listing of sponsoring agencies includes the following: Agency for International Development, Air Force Office of Scientific Research, Alternative Energy Corporation, Aluminum Company of America, American Chemical Society, American Institute of Industrial Engineers, American Lung Association, American Enka, Army Research Office, Associated General Contractors, Association of Synthetic Yarn Manufacturers, Inc., Atomic Energy Commission, Battelle, Becton-Dickinson, Blythe Brothers Company, Burlington Industries, Burroughs Wellcome, Carolina Power and Light Company, Carolina Tractor and Equipment Company, Celanese Corporation, Central Pharmaceuticals, Inc., Champion International, Chemstrand, Cities Service Foundation, Cotton, Inc., Crown Zellerbach Foundation, Department of Energy, Department of Health and Human Services, Department of Transportation, Douglas Aircraft Company, Dow Chemical Company, Dreyfus Foundation, EAR Corporation, E. I. DuPont de Nemours Company, E. Sigurd Johnson, Eastman Kodak Company, Environmental Protection Agency, Ford Foundation, Ford Motor Company, General Electric Corporation, General Foods Corporation, Gifford-Hill and Company, Glass Packaging Institute, Goodyear Tire and Rubber Company, Harry B. Gilbert, Hercules, Inc., Hercules Powder Company, Institute of Nuclear Power Operations, Institute of Transportation Research and Education, International Business Machines, International Institute of Education, International Nickel Corporation, International Potato Center, ITT Rayonier Foundation, Kamphoefner Honor, Lockheed Aircraft, Marine Colloids Institute, Marine Science Development Grants, Martin-Marietta Aggregates, Materials Handling Institute, Microelectronics Center of N. C., Minnesota Mining and Manufacturing, Monsanto Chemical Company, National

Aeronautics and Space Administration, National Center for Health Services Research, National Institute of Occupational Safety and Health, National Institute on Aging, National Institutes of Health, National Science Foundation, N. C. Agricultural Foundation, N. C. Board of Science and Technology, N. C. Chapter of the Soil Conservation Society of America, N. C. Dairy Foundation, N. C. Department of Administration, N. C. Department of Commerce, N. C. Department of Community Colleges, N. C. Department of Crime Control and Public Safety, N. C. Department of Human Resources, N. C. Department of Natural and Economic Resources, N. C. Energy Institute, N. C. Marine Science Council, N. C. State Board of Education, N. C. State University Alumni Association, N. C. Textile Foundation, N. C. Tobacco Foundation, Occidental, Office of Naval Research, Office of Water Research and Technology, Owens-Corning Fiberglass Corporation, Partitions, Inc., Pfizer, Inc., Philip-Morris, Phillips Petroleum Company, Physics International Company, Plastics Institute of America, Proctor and Gamble, Pulp and Paper Foundation, Inc., Remington Arms Company, R. J. Reynolds Tobacco Company, Ready-Mixed Concrete Company, Research Corporation—Cottell Research Grants Program, Research Triangle Institute, Resources for the Future, Reynolds Institute, Reynolds Metals Company, Rockefeller Foundation, Sam Lynch Associates, Science Applications, Inc., Sea Grant, Selenium-Tellurium Development Association, Inc., Shell Companies Foundation, The Sherwin-Williams Company, Six Associates, Smith-Richardson Foundation/Hudson Institute, Society of Manufacturing Engineers, Solar Energy Research Institute, Southeastern Association of Game and Fish Commissions, Southeastern Cooperative Fish and Game Statistics Project, Southeastern Gas Association, Southern Furniture Manufacturers Association, Southern Solar Energy Consortium, Tau Beta Pi, Union Camp Corporation, Union Carbide Corporation, U. S. Agency for International Development, U. S. Army, U. S. Department of Agriculture, U. S. Department of Commerce, U. S. Department of Defense, U. S. Department of Drug Administration, U. S. Department of Education, U. S. Department of Housing and Urban Development, U. S. Department of the Interior, U. S. Department of Labor, U. S. Department of Transportation, U. S. Forest Service, U. S. Public Health Service, The University of North Carolina Sea Grant Program, The W. K. Kellogg Foundation, Walker Martin, Water Resources Research Institute, Western Electric Company, Weyerhaeuser Company, William H. Deitrick, and Woods Hole Oceanographic Institution.

MINORITY PRESENCE GRANT PROGRAM

Under the Board of Governors general Minority Presence Grant Program, black students may be eligible for special financial assistance if they are residents of North Carolina, enrolled for at least three hours of degree-credit coursework and demonstrate financial need.

The Minority Presence Grant Program for Doctoral Study, Law and Veterinary Medicine provides stipends of up to \$4,000 for the academic year, with an option of \$500 in additional support for study in the summer session, for black residents of

North Carolina who are selected to participate. Recipients must be full-time students pursuing doctoral degrees, law degrees or degrees in veterinary medicine at East Carolina University, North Carolina State University, The University of North Carolina at Chapel Hill or The University of North Carolina at Greensboro.

Other Financial Aid

LONG-TERM LOANS

National Direct Student Loans (Formerly National Defense Student Loans): Graduate students who are American citizens or eligible noncitizens may apply to the Financial Aid Office for consideration for long term, low interest loans. To qualify for loans, students must be making satisfactory academic progress and must show financial need. The Financial Aid Form is the proper form to be completed for financial aid consideration. Other required forms—a Student Data Sheet and Financial Aid Transcript if needed—should be requested along with the FAF from the University's Financial Aid Office. Students are expected to apply for and to accept any available assistantships before applying for loans. In the event that the funds available through the Financial Aid Office are insufficient to meet the need of all students who apply and are eligible, priority for these loans will be given to students working on their first undergraduate degree and graduate students will be referred to other programs (see Guaranteed Student Loans).

Graduate students may borrow up to \$12,000 inclusive of any undergraduate National Direct Student (National Defense Student) Loans. There is no interest on the loan while the borrower is a full- or half-time student at an institution of higher education. Six months after ceasing to be at least a half-time student, interest begins at five percent per year. The repayment period begins at the same time. A ten-year repayment period is possible for large indebtedness; however, a minimum payment of \$30 per month is required. Interest does not accrue and repayment installments may be postponed during any period not in excess of three years during which the borrower is a member of the Armed Forces of the United States or is a Peace Corps or Vista volunteer. Reduction of obligations to repay may result from teaching in schools with high concentrations of low income families or from teaching handicapped children. New legislation also provides that the Defense Department may repay a portion of your loan if you serve as an enlisted person in certain military occupations after receiving an NDSL.

Institutional Long Term Loans: These loans are made from University funds. Institutional loans are made and are to be repaid under the same terms as the National Direct Student Loans except that there are no forgiveness features.

Guaranteed Student Loan Program: This program provides loans from private lenders. Procedures are different in each state. Information for available loans may be obtained in the Financial Aid Office. Interest is at eight percent per year with the Federal Government paying the interest during the in-school period. To be eligible for this loan and the interest benefits, the total of the student's and

the parents' (if applicable) adjusted gross income must be less than \$30,000 for the year prior to the academic year for which the loan is being requested. When the income exceeds \$30,000, the family must demonstrate financial need based on guidelines issued by the Department of Education in order to be eligible for the loan.

Legal residents of North Carolina who are enrolled in a degree program may borrow under the Guaranteed Student Loan Program through College Foundation, Inc., a maximum of \$5,000 per academic year or the total cost of education less other financial aid (including assistantships and fellowships), whichever is less. A maximum of \$25,000 may be borrowed for *all* undergraduate and graduate school Guaranteed Student Loans. College Foundation Loans are insured by the North Carolina Education Assistance Authority or the United States Department of Education. Students from other states may obtain information about similar plans from the Financial Aid Office.

PART-TIME JOBS

The College Work Study Program is a federal program designed to provide part-time jobs to students who show need of financial assistance. The same application, the Financial Aid Form, is used to apply for both loans and jobs. Effort is made to assign students to jobs in keeping with their special interests and skills. As is the case with campus-administered loans, priority for these funds is given to undergraduate students pursuing their first undergraduate degree.

Other jobs not based on need are listed at the Financial Aid Office and are open to all students.

SHORT-TERM EMERGENCY LOANS

Loans, usually in amounts of \$100 or less, to meet emergency expenses may be obtained on short notice at the Financial Aid Office. These loans, in that they are designed for short term, emergency use, must be repaid within about 30 days. A loan may not be taken out between semesters or summer sessions.

Military Education and Training

The Reserve Officer Training Corps (ROTC) selects interested University students for enrollment in Army ROTC (AROTC) or in Air Force ROTC (AFROTC) for officer education and training leading toward a commission.

The Army and Air Force ROTC departments educate and train University students, graduate and undergraduate, for a commission in their respective military services. These students must have four full semesters (undergraduate or graduate) remaining at the time they enter the ROTC Program (exceptions for Army ROTC are noted below). Uniforms and books for ROTC are provided. Transfer credit is allowed for previous ROTC course work at other institutions.

Graduate students who will be at NCSU for at least two years may, upon successful completion of a six-weeks' summer training period, be enrolled in the Air

Force ROTC Program. Entry requirements for either program may also be met by having met any *one* of the following requirements:

1. Completed basic level ROTC courses as an undergraduate.
2. Be an honorably discharged veteran.
3. Have completed military basic training and be a member of an Army/Air Force Reserve or National Guard Unit.
4. Successfully complete a two-weeks, on-campus program (Army ROTC only).

Air Force ROTC offers a Flight Training Program for selected cadets which is conducted by a local civilian flying school at no expense to the student. Students successfully completing ROTC flight training may be selected for further flight training as an Air Force pilot.

Graduate students enrolled in the junior and senior years of ROTC receive \$100 per month. Scholarships which pay all tuition, fees and costs of required textbooks in addition to the \$100 per month are available on a competitive basis.

Special provisions for veterans are made in Army ROTC whereby they are granted placement credit for their prior service experience and training. Additionally, Army ROTC offers the student several points of entry into the ROTC Program, under a process of granting ROTC placement credit for college courses or other worthwhile experiences that contribute to the requisite skills of a second lieutenant. Army ROTC counselors are available to evaluate the students' prior learning experiences and advise them as to where they can be placed in ROTC. Under the Army's Simultaneous Membership Program, the graduate student may participate in the Army Reserve or National Guard and receive approximately \$84 per month in addition to the \$100 monthly stipend. The National Guard provides up to \$500 tuition costs per year for its members. The student must enlist in the specified component and have completed basic training prior to entry into the program.

Additional information on Army ROTC may be obtained from the Professor of Military Science, Room 154, Reynolds Coliseum (737-2428) and Air Force ROTC from the Professor of Aerospace Studies, Room 145, Reynolds Coliseum (737-2417).

Health Services

The Student Health Service, located in Clark Hall Infirmary, offers health care to students on an outpatient and inpatient basis. The facility is fully staffed by seven full-time physicians, two Family Nurse Practitioners, a pharmacist, registered nurses, laboratory technicians and support staff.

During fall and spring semester, the Health Service is open 24 hours a day, seven days a week. Outpatient hours only are observed during semester breaks and summer sessions. Physicians maintain regular office hours Monday through Friday and are on call at all times to assist the nurses on duty when the condition of a patient warrants immediate attention.

All currently enrolled students are eligible for medical care. The student health fee covers professional services both outpatient and inpatient; *i.e.*, visits to staff physicians, laboratory tests and X-rays performed in the Student Health Service and all medications available in the student pharmacy. There is a nominal charge for x-rays.

The University annually offers students the opportunity to enroll in a student group health and accident insurance plan which provides for the cost of referrals to off-campus specialists or to local hospitals for surgery and serious illnesses.

International students are required to enroll in a student health insurance program.

Housing

The University operates 18 residence halls for single students with a total capacity to accommodate approximately 6,200 students. Seven of the halls are arranged in suites of four or five rooms with a common bathroom and the other eleven have rooms which open onto a central corridor with bathrooms at intervals. All rooms are designed for double or triple occupancy and are furnished except for pillows and linen. An optional linen rental service is available through the Auxiliary Services Office.

The 1983-84 rental fee for a resident hall double room is \$500 per semester per student and may increase in future years. (Room rents in North Hall and South Hall are higher.) New freshmen and continuing residents have priority for a room assignment over new graduate students. *Because of the demand for on-campus housing, it is unlikely that new graduate students may obtain residence hall rooms during the full semester.* However, these students may contact the Student Housing Office, 201 Harris Hall, *after Registration Day* concerning the availability of housing on campus at that time.

The Student Housing Office also maintains a self-help facility which makes available listings of off-campus housing accommodations sent to them by private landlords; however, specific arrangements for this housing must be contracted for by those individuals concerned. The listings are not mailed as they change frequently and most landlords and tenants prefer to complete the rental transaction in person rather than by telephone or mail. The Student Housing Office is open from 8:00 a.m. until 5:00 p.m., Monday through Friday only.

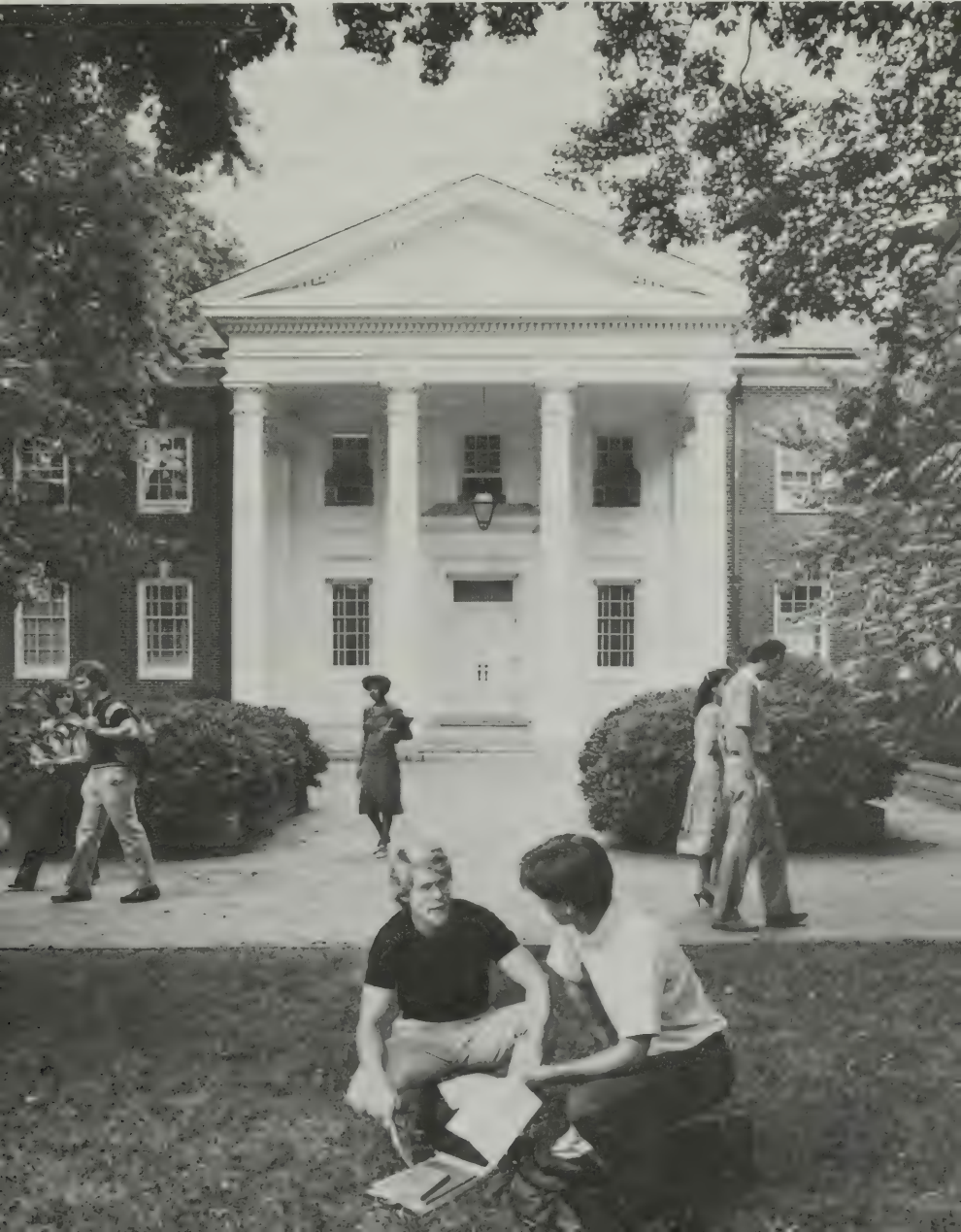
The University does not operate a trailer park, but there are privately owned parks within a reasonable distance of the campus.

MARRIED STUDENT HOUSING

The University also maintains 300 apartments for married students, including efficiency, one-bedroom and two-bedroom units. The monthly rental rates for the 1983-84 year are \$167 (includes gas) for efficiencies, \$160 for one-bedroom apartments and \$180 for the two-bedroom units. All apartments have built-in dresser drawers, closets, a stove and a refrigerator. Interested students should write to King Village Office, P Building, North Carolina State University, Raleigh, NC 27607 for family housing application and information or telephone (919) 737-2430.

Additional Information

If additional information is needed, contact the Graduate School, 104 Peele Hall, P. O. Box 7102, North Carolina State University, Raleigh, N.C. 27695-7102 (telephone 919/737-2871).



GRADUATE PROGRAMS

The Graduate School offers programs of study leading to the master's degree in 71 fields and the doctorate in 46. Each student's program is planned with an advisory committee of graduate faculty members to provide the opportunity for gaining advanced knowledge in the particular field of study. Graduate education is the final stage in the development of intellectual independence. It is different from undergraduate education in that the student is encouraged to establish premises, to hypothesize and to defend both the procedure and the conclusions of independent investigation. The burden of proof for the verifiability of knowledge rests on the student, not on the faculty member. Emphasis is placed upon the student's scholarly development through formal course work, seminars, research and independent investigation.

Graduate students are expected to familiarize themselves with the requirements for the degrees for which they are candidates and are held responsible for the fulfillment of these requirements.

Master's Degrees

The Graduate School offers programs of study leading to the Master of Science degree, the Master of Arts degree and the Master's degree in certain designated fields.

MASTER OF SCIENCE AND MASTER OF ARTS

For all Master of Science and Master of Arts degrees, the programs are planned with the objective of making possible a reasonable, comprehensive mastery of the subject matter in the chosen field. Training and experience in research are provided to familiarize the student with the methods, ideals and goals of independent investigation.

The Master of Science degree is awarded in the following fields:

Adult and Community College Education
Agricultural Economics
Agricultural Education
Animal Science
Applied Mathematics
Biochemistry
Biological and Agricultural Engineering
Biomathematics
Botany
Chemical Engineering
Chemistry
Civil Engineering
Computer Studies

Crop Science
Curriculum and Instruction
Ecology
Educational Administration and Supervision
Electrical Engineering
Entomology
Food Science
Forestry
Genetics
Guidance and Personnel Services
Horticultural Science
Industrial Arts Education
Industrial Engineering

Management
Marine, Earth and Atmospheric
Sciences
Materials Engineering
Mathematics
Mathematics Education
Mechanical Engineering
Microbiology
Nuclear Engineering
Nutrition
Occupational Education
Operations Research
Physics
Physiology
Plant Pathology
Poultry Science

Psychology
Recreation Resources
Administration
Rural Sociology
Science Education
Soil Science
Special Education
Statistics
Textile Chemistry
Textiles
Toxicology
Veterinary Medical Sciences
Vocational Industrial Education
Wildlife Biology
Wood and Paper Science
Zoology

The Master of Arts degree is offered in Economics, English, History and Political Science.

ADVISORY COMMITTEE AND PLAN OF GRADUATE WORK

The advisory committee is composed of at least three members of the Graduate Faculty, one of whom is designated as the chair and one of whom represents the supporting area. This committee is appointed by the Graduate Dean upon the recommendation of the head of the major department.

The student's program of study is planned so as to provide a comprehensive view of the major field of interest and to provide training in research in this field and related areas of knowledge. As great a latitude is permitted in the selection of courses as is compatible with a well-defined major and supporting courses. In general, it is expected that approximately two-thirds of the course work will be in the major and one-third in supporting courses. Since there are many possible combinations of course work, a specific Plan of Graduate Work is developed by the advisory committee with the student. The program of course work to be followed by the student and the thesis problem selected must be approved by the student's advisory committee, the head of the department and the Graduate School. The Plan of Graduate Work should be submitted to the Graduate School for approval prior to completion of one-half of the program.

RESIDENCE

Students engaged in a course of study leading to the Master of Science or Master of Arts degree are required to be in residence, pursuing graduate work, for a minimum of one full academic year or its equivalent.

CREDITS

A minimum of 30 semester credits is required for the Master of Science or Master of Arts; however, the number of credit hours included in a Plan of Graduate Work often exceeds this minimum. At least 20 semester hours must come from 500- and 600-level courses, with no fewer than six credits being at the 600-level. The program may include no more than six hours of research and no more than two hours of departmental seminar, unless the total program exceeds 30 hours. Courses at the 400-level counted toward the minimal 30-hour requirement may not come from the major field.

CREDIT FROM OUTSIDE SOURCES

1. Generally, no more than six of the required academic credits will be accepted from other institutions. A graduate course may be considered for transfer to a master's program provided it has been completed in a graduate classification at an accredited graduate school with a grade of "B" or better.
2. No graduate credit will be allowed for excess credits completed in an undergraduate classification at another institution.
3. No graduate credit will be allowed for correspondence courses.
4. A maximum of six semester credits earned through North Carolina State University Extension study may be applied toward degree requirements provided the courses are graduate level and are taught by members of the University graduate faculty. Transfer credit is not granted for courses taken by extension at other institutions. If a student has been admitted to the Graduate School and an approved Plan of Graduate Work has been submitted, six additional semester credits may be obtained in off-campus North Carolina State University graduate courses to apply toward the minimal credit hour requirement for the degree. Credit accepted by extension reduces the amount of credit which may be transferred from other institutions.

GRADING AND ACADEMIC STANDING

Performance in lecture courses is evaluated as "A" (Excellent), "B" (Good), "C" (Passing), "D" or "NC" (No Credit). In order to receive graduate degree credit, a grade of "C" or higher is required. All grades on courses taken for graduate credit as an undergraduate at NCSU and all grades on courses taken in a graduate classification at NCSU in courses numbered 400 and above are included in the graduate grade point average. Courses at the 300 level and below are not considered for graduate credit and grades earned on them do not enter the grade point average.

Performance in research, seminar and special problems courses is evaluated as either "S" (Satisfactory) or "U" (Unsatisfactory), and these grades are not used in computing the grade point average. However, a student who receives a "U" on any course will not receive credit for that course and may be required to repeat it.

The "Master Listing of Approved Graduate Courses" identifies the approved grading (A,B,C,D,NC or S,U) for each 500- and 600-level course. Any deviation from the approved grading for a particular course must be requested by the depart-

ment and approved by the Academic School Dean and the Graduate Dean prior to teaching the course.

The grade of "IN" (Incomplete) may be given in any course at the discretion of the instructor. A student who receives an "IN" must complete the unfinished work to have the Incomplete converted to a final grade by the end of the next semester in which the student is enrolled provided that this period is not longer than 12 months from the end of the semester or summer session in which the Incomplete was received; otherwise, the "IN" will be automatically converted to "NC" or "U," in accord with the grading approved for the particular course. All grades of "IN" must be cleared prior to graduation.

Except in the case of Interinstitutional Registration (see p. 30), grades on courses transferred from another institution will not be included in computing the grade point average.

Graduate students are given a notice of academic warning if they have accumulated less than nine hours at the 400-level or above and have less than a 3.0 ("B" average). Graduate students are placed on academic probation if they accumulate nine or more but less than eighteen credit hours at the 400-level or above and have a grade point average of less than 3.0 ("B" average). A student's graduate study is terminated if eighteen or more credit hours at the 400-level or above are accumulated with a grade point average of less than 3.0 ("B" average). In the case of program termination, no further registration in a graduate classification will be permitted. Under extenuating circumstances the student will be reinstated upon the written recommendation of the department and approval by the Graduate Dean. (Effective Fall 1978 for all graduate students.) Departments have the prerogative of recommending the termination of a student's graduate admission at any time.

Students who are eligible to attend the first summer session are eligible to attend either or both summer sessions. For example, students who receive a notice of "Graduate Admission Terminated" at the end of the first summer session may register for the second summer session unless the major department recommends otherwise.

A graduate student must be in good academic standing (B or better average) to be eligible for appointment to an assistantship, fellowship or traineeship and must be registered in each semester in which the appointment is in effect.

LANGUAGE REQUIREMENTS

A reading knowledge of one modern foreign language (Germanic, Romance or Slavic) is required of students pursuing the Master of Arts in English and of students engaged in the Master of Science programs in chemistry and mathematics. In the Master of Arts program in political science, competence in a foreign language or in research methodology is required. The Departments of Entomology, History and Mathematics and Science Education leave the decision to the student's advisory committee.

Proficiency can be demonstrated in one of two ways:

1. By passing a traditional reading knowledge examination, which can be requested by the student at any time.

2. By passing the final examination in a course especially designed for graduate students who have no previous knowledge of a foreign language or who wish to refresh their knowledge of a language. The Department of Foreign Languages and Literatures offers such courses, normally in the fall, for each of the three major foreign languages: French (FLF 401), German (FLG 401) and Spanish (FLS 401). These courses concentrate exclusively on teaching students to understand the written word and do not provide instruction or testing in speaking and original composition. Failure to pass the course carries with it no penalty other than the fact that the student's language requirement will remain unfulfilled. These courses are neither counted for credit nor used in computing the grade point average.

THESIS

Theses prepared by candidates for the Master of Science or Master of Arts degree must represent an original investigation into a subject which has been approved by the student's advisory committee and the head of the major department. Three copies of the thesis in final form as approved by the advisory committee, each signed by the members of the advisory committee, must be submitted to the Graduate School by a specific deadline in the semester or summer session in which the degree is to be conferred. Detailed information on form and organization of the thesis is presented in the University's *Guide for the Preparation of Theses*, which is available in the Graduate School office.

COMPREHENSIVE WRITTEN EXAMINATIONS

Written examinations covering the subject matter of the major and supporting fields may be required of the candidate. When required, such examinations must be successfully completed prior to requesting the comprehensive oral examination. Information concerning written examination schedules should be obtained from the student's major department.

COMPREHENSIVE ORAL EXAMINATIONS

A candidate for the Master of Science or Master of Arts degree must pass a comprehensive oral examination to demonstrate to the advisory committee that he or she possesses a reasonable mastery of the subject matter of the major and supporting fields and that this knowledge can be used with promptness and accuracy. This examination may not be held until all other requirements, except completion of the course work for the final semester, are satisfied. Application for the examination must be filed with the Dean of the Graduate School by the chair of the advisory committee at least two weeks prior to the date on which the examination is to be held and must be accompanied by certification that the thesis is complete except for such revisions which may be necessary as a result of the final examination.

A unanimous vote of approval by the advisory committee is required for passing the oral examination. Approval of the examination may be conditioned, however, upon the completion of additional work to the satisfaction of the advisory commit-

tee. A formal reexamination will not be required in this case. Failure of a student to pass the oral examination terminates the student's graduate work at this institution unless otherwise unanimously recommended by the advisory committee. Only one reexamination will be permitted. All committee actions may be appealed by written application to the Graduate Dean.

Oral examinations for master's degree candidates are open to the graduate faculty by right and to the University community by unanimous consent of the advisory committee and the student being examined. Discussions and decisions regarding the student's performance are private to the advisory committee.

TIME LIMIT

All requirements for the master's degree must be completed within six calendar years, beginning with the date the student commences courses carrying graduate credit applicable to the degree program, unless a more restrictive time limit has been established by the academic school.

MASTER'S DEGREE IN A DESIGNATED FIELD

The University offers a number of master's degree programs in designated fields. The degree offerings are listed below. These programs vary in requirements and persons having an interest in these programs are advised to contact the major department for further information including specific prerequisites and degree requirements. General Graduate School policies as stated on page 44 through 49 apply to these degree programs with the exception of references to the master's thesis.*

Following is a listing of the degrees that may be awarded upon the completion of the course of study in a designated field:

Master of Agriculture
Master of Architecture
Master of Biological and
Agricultural Engineering

Master of Biomathematics
Master of Chemical Engineering
Master of Civil Engineering
Master of Computer Studies
Master of Economics
Master of Education**
Master of Electrical Engineering
Master of Engineering***

Master of Forestry
Master of Industrial Engineering
Master of Technology for
International Development
Master of Landscape Architecture
Master of Life Sciences
Master of Mechanical Engineering
Master of Nuclear Engineering
Master of Product Design
Master of Public Affairs
Master of Recreation Resources
Master of Sociology

*Students in programs leading to the Master of Education degree may elect a thesis option or they may complete the course "Introduction to Educational Inquiry" or a departmental course in research and a problem report.

**The following programs in the School of Education offer courses of study leading to the Master of Education degree: adult and community college education, agricultural education, curriculum and instruction, educational administration and supervision, guidance and personnel services, industrial arts education, mathematics education, occupational education, science education, special education and vocational industrial education.

***Off-campus only.

Master of Statistics

Master of Textiles

Master of Urban Design****

Master of Wildlife Biology

Master of Wood and Paper Science

Summary of Procedures for Master's Degrees

1. Letter of inquiry from prospective student to Graduate School or department head.
2. Mailing of proper forms to student.
3. Receipt of application materials and required fee.
4. Review of application materials by department or program.
5. Department forwards recommendation regarding applicant's admissibility to Graduate Dean.
6. The department's recommendation is reviewed and the student is notified of the action taken on the request for admission.
7. Student arrives, reports to the department, is assigned an adviser and makes out a roster of courses in consultation with the departmental adviser.
8. Advisory committee of three or more graduate faculty members, one of whom is designated as the chair and one of whom represents the supporting field, appointed by the Graduate Dean upon the recommendation of the department head.
9. Plan of Work prepared by the advisory committee with the student and submitted in quadruplicate to the department head and the Graduate School for approval prior to completion of one-half of the proposed program.
10. Three copies of the approved Plan of Work returned to the department. One copy is kept in department files, one is returned to the committee chair and one is given to the student.
11. Student passes language examination (if required by the major department).
12. Written examination in the major and/or supporting fields may be required of the candidate. If required, written examinations must be successfully completed prior to requesting the comprehensive oral examination.
13. A copy of a preliminary draft of the thesis is submitted to the chair of the student's advisory committee for review. (Thesis degrees only).
14. The diploma order request form must be filed with the Graduate School by the end of the third week of the semester or summer session of anticipated graduation. Failure to submit the form by this date may result in the student's not receiving the diploma at graduation.
15. At least two weeks prior to the final oral examination, the chair of the student's advisory committee submits the thesis to advisory committee members for review. (Thesis degrees only).
16. The final oral examination may be scheduled when all other requirements, except completion of the course work for the final semester, are satisfied. Permission for the candidate to take the final oral examination is requested of the Graduate School at least two weeks before the examination and, in the case of thesis degrees, must be accompanied by a certification that the thesis is com-

****No new applications are being accepted. Students interested in this area should contact the School of Design.

plete except for such revisions as may be necessary as a result of the final examination. Specific deadline dates for non-thesis master's candidates appear in The Calendar.

17. The Graduate Dean schedules the examination and notifies the student and advisory committee of the time and place. The report on the final examination should be filed with the Graduate School as soon as the examination has been completed.
18. Three copies of the thesis signed by each member of the student's advisory committee must be submitted to the Graduate School by a specific deadline in the semester or summer session in which the degree is to be conferred. Specific deadline dates appear in The Calendar.
19. The thesis is reviewed by the Graduate School to insure that the format conforms with the specifications prescribed in the *Guide for the Preparation of Theses*. (Thesis degrees only).
20. All course work scheduled in a graduate degree classification must be completed prior to graduation.
21. A grade point average of at least 3.0 is required for graduation.
22. All degree requirements must be completed within six calendar years, beginning with the date the student commences courses carrying graduate credit applicable to the degree program, unless a more restrictive time limit has been established by the academic school.

Doctor of Philosophy and Doctor of Education Degrees

The doctorate symbolizes the ability of the recipient to undertake original research and scholarly work at the highest levels without supervision. The degree is therefore not granted simply upon completion of a stated amount of course work but rather upon demonstration by the student of a comprehensive knowledge and high attainment in scholarship in a specialized field of study. The student must demonstrate this ability by writing a dissertation reporting the results of an original investigation and by passing a series of comprehensive examinations in the field of specialization and related areas of knowledge.

The Doctor of Philosophy degree is offered in the following fields of study:

Animal Science
Applied Mathematics
Biochemistry
Biological and Agricultural
Engineering
Biomathematics
Botany
Chemical Engineering
Chemistry
Civil Engineering
Crop Science
Economics
Electrical Engineering

Entomology
Fiber and Polymer Science
Food Science
Forestry
Genetics
Horticultural Science
Industrial Engineering
Marine, Earth and Atmospheric
Sciences
Materials Engineering
Mathematics
Mathematics Education
Mechanical Engineering

Microbiology
Nuclear Engineering
Nutrition
Operations Research
Physics
Physiology
Plant Pathology
Psychology

Science Education
Sociology
Soil Science
Statistics
Toxicology
Veterinary Medical Sciences
Wood and Paper Science
Zoology

The Doctor of Education degree is offered in the following fields:

Adult and Community College Education	Guidance and Personnel Services
Curriculum and Instruction	Industrial Arts Education
Educational Administration and Supervision	Occupational Education

ADVISORY COMMITTEE AND PLAN OF GRADUATE WORK

An advisory committee of at least four graduate faculty members, one of whom will be designated as chair, will be appointed by the Dean of the Graduate School upon the recommendation of the head of the major department. The committee, which must include at least one representative of the minor field, will, with the student, prepare a Plan of Graduate Work which must be approved by the department head and the Graduate School. In addition to the course work to be undertaken, the subject of the student's dissertation must appear on the plan; and any subsequent changes in subject or in the overall plan must be submitted for approval.

The program of work must be unified, and all constituent parts must contribute to an organized program of study and research. Courses must be selected from groups embracing one principal subject of concentration, the major, and from a cognate field, the minor. Normally, a student will select the minor work from a single discipline or field which, in the judgment of the advisory committee, provides relevant support to the major field. However, when the advisory committee finds that the needs of the student will best be served by work in an interdisciplinary minor, it has the alternative of developing a special program in lieu of the usual minor.

RESIDENCE REQUIREMENT

For the Doctor of Philosophy and the Doctor of Education degrees, the student is expected to be registered for graduate work at an accredited graduate school for at least six semesters beyond the baccalaureate degree.

The basic University residence requirements are defined below. However, academic schools have the prerogative of establishing more restrictive requirements within the respective schools. (The School of Education requires a minimum of one academic year of full-time resident study).

At least two residence credits, as defined below, must be secured in continuous residence (registration in consecutive semesters) as a graduate student at the University. Failure to take work during the summer does not break continuity; however, summer work may be used in partial fulfillment of this requirement.

Residence credit is determined by the number of semester hours of graduate work carried during a given term. During a regular semester, residence credit is calculated in the following manner:

<i>Semester Credits (Hours)</i>	<i>Residence Credits</i>
9 or more	1
6-8	2/3
less than 6 (including registration for "Thesis Preparation")	1/3

The residence credit for a six-week summer term is equal to one-half of the corresponding amount for a regular semester. For example, six semester hours carried during a summer session will earn one-third of a residence credit; less than six credit hours will earn one-sixth of a residence credit.

GRADING AND ACADEMIC STANDING

The grading system and grade requirements for all doctoral programs are the same as those for master's degree programs, as described on pages 46-47.

LANGUAGE REQUIREMENTS

A reading knowledge of at least one modern foreign language is required by some departments for the Doctor of Philosophy degree. Doctoral students should contact the major department for specific language requirements. For the Doctor of Education degree, the decision as to whether or not there will be a language requirement is left to the student's advisory committee.

Students who choose to demonstrate a reading knowledge of a language may select from any of the Romance, Germanic or Slavic languages (or any combination in those programs requiring two languages). The Department of Foreign Languages and Literatures offers courses in French, German and Spanish especially designed for graduate students who have no previous knowledge of a foreign language or who wish to refresh their knowledge of a language. These courses concentrate exclusively on teaching students to understand the written word and do not provide instruction or testing in speaking and original composition. A passing grade on the final examination in one of these courses is sufficient evidence of a reading knowledge of the language.

To demonstrate comprehension in depth of one language, a student must not only prove that one possesses a reading knowledge of the language but also that he or she is proficient in the oral and compositional elements of that language. Students desiring to master one language in depth should consult the head of the Department of Foreign Languages and Literatures concerning the specific courses which will be necessary to achieve this comprehension; specific arrangements will depend upon the student's background in the language.

Students whose native language is other than English may use English as one of the languages when two are required for the Doctor of Philosophy degree. When English is submitted in partial fulfillment of the dual language requirement, the native language may not be used as the other language.

When only one language is required in the student's program, certification for that language must occur on this campus.

PRELIMINARY COMPREHENSIVE EXAMINATIONS

After completing the language requirement but not earlier than the end of the second year of graduate study and not later than one semester (four months) before the final oral examination, each doctoral student is required to take the preliminary comprehensive examinations. The examinations consist of two parts: written examinations and an oral examination. Requirements for written examinations in the minor field are left to the discretion of the department in which the student is minoring.

The written portion may be conducted in one of two ways. In the first, each member of the advisory committee prepares a set of questions for the student's response, and answers to each set are returned to the appropriate member for grading. This procedure is used by departments which have a relatively small number of doctoral students.

Many of the larger departments have developed departmental written examinations to be used for all students. These examinations are given several times during the year, and scheduled dates are announced well in advance. Where written departmental examinations of this kind are used, the student will be expected to make arrangements to schedule these examinations.

Regardless of the method employed, the questions involved may cover any phase of the course work taken by the student during graduate study or any subject logically related to an understanding of the subject matter in the major and minor areas of study. The questions are designed to measure the student's mastery of the subject matter and the adequacy of preparation for research. Failure to pass the written preliminary examinations terminates the student's work at this institution, subject to departmental and/or school policies with respect to reexamination.

Upon satisfactory completion of the written portion of the preliminary examinations, authorization for the preliminary oral examination is requested from the Graduate School. This examination is conducted by the student's advisory committee and a representative from the Graduate School and is open to all graduate faculty members. The student and the examining committee will be notified by the Graduate School of the arranged time and place. The oral examination is designed to test the student's ability to relate factual knowledge to specific circumstances, to use this knowledge with accuracy and promptness and to demonstrate a comprehensive understanding of the field of specialization and related areas.

A unanimous vote of approval by the members of the advisory committee is required for the student to pass the preliminary oral examination. Approval may be conditioned, however, on the successful completion of additional work in some particular field(s). All committee actions may be appealed by written application to the Graduate Dean.

Failure to pass the preliminary oral examination terminates the student's work at this institution unless the examining committee recommends a reexamination. No reexamination may be given until at least one full semester has elapsed, and only one reexamination is permitted.

CANDIDACY

A doctoral student is admitted to candidacy upon passing the preliminary examinations without conditions or after fulfilling any conditions specified by the advisory committee.

FINAL ORAL EXAMINATION

The final oral examination is scheduled after the dissertation is complete except for such revisions as may be necessary as a result of the examination, but not earlier than one semester or its equivalent after admission to candidacy. The examination consists of the candidate's defense of the methodology used and the conclusions reached in the research, as reported in the dissertation. It is conducted by an examining committee, which consists of the student's advisory committee and a Graduate School representative. This examination is open to the University community.

A unanimous vote of approval of the advisory committee is required for passing the final oral examination. Approval may be conditioned, however, on the student's meeting specific requirements prescribed by the student's advisory committee. Failure of a student to pass the examination terminates one's work at this institution unless the advisory committee recommends a reexamination. No reexamination may be given until one full semester has elapsed and only one reexamination is permitted.

THE DISSERTATION

The doctoral dissertation presents the results of the student's original investigation in the field of major interest. It must represent a contribution to knowledge, be adequately supported by data and be written in a manner consistent with the highest standards of scholarship. Publication is expected.

The dissertation will be reviewed by all members of the advisory committee and must receive their approval prior to submission to the Graduate School. Two copies of the document signed by all members of the student's advisory committee must be submitted to the Graduate School by a specific deadline in the semester or summer session in which the degree is to be conferred. Prior to final approval, the dissertation will be reviewed by the Graduate School to insure that the format conforms to the specifications prescribed in the *Guide for the Preparation of Theses*. Detailed information on form and organization of the dissertation is presented in the University's *Guide for the Preparation of Theses* which is available in the Graduate School office.

The University has a requirement that all doctoral dissertations be microfilmed by University Microfilms International, of Ann Arbor, Michigan, which includes publication of the abstract in *Dissertation Abstracts International*. The student is required to pay for the microfilming service. (See "Special Registration and Fees" under "Tuition and Fees.")

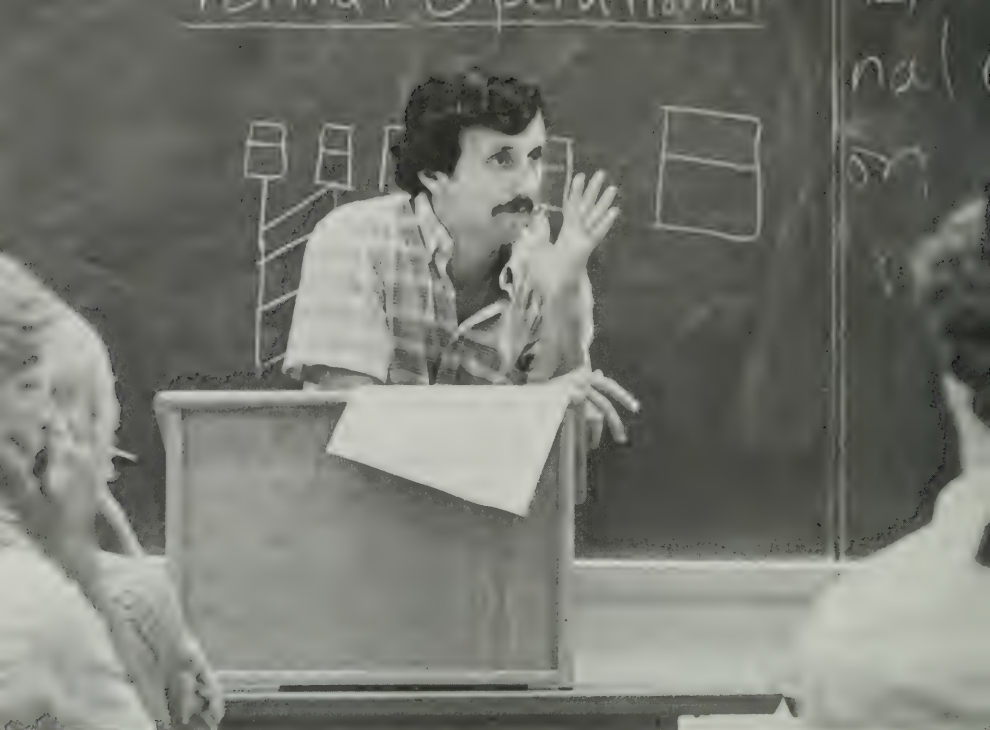
TIME LIMIT

Doctoral students are allowed a maximum of six calendar years from admission to the doctoral program to attain candidacy for the degree and a maximum of ten calendar years to complete all degree requirements. Academic schools or departments may have more restrictive requirements than the above stated University policy. All students admitted to doctoral programs effective Fall 1979 are subject to the above policy. Time limits for students admitted to doctoral programs prior to Fall 1979 but who were not admitted to candidacy as of Fall 1979 and who do not meet the above policy will be considered on an individual basis. Doctoral students admitted to candidacy prior to the 1979 fall semester are subject to the previous policy which allowed seven calendar years from admission to candidacy to completion of all degree requirements.

Summary of Procedures for the Doctor of Philosophy and Doctor of Education Degrees

1. Letter of inquiry from prospective student to Graduate School or department head.
2. Mailing of proper forms to student.
3. Receipt of application materials and required fee.
4. Review of application materials by department or program.
5. Department forwards recommendation regarding applicant's admissibility to Graduate Dean
6. The department's recommendation is reviewed and the student is notified of the action taken on the request for admission.
7. Student arrives, reports to the department, is assigned an adviser and makes out a roster of courses in consultation with the departmental adviser.
8. Advisory committee of at least four graduate faculty members, one of whom is designated as the chair and one of whom represents the minor field, appointed by the Graduate Dean upon the recommendation of the department head.
9. A dissertation subject is selected and an outline of the proposed research submitted to the student's advisory committee and the department head for review and approval.
10. Plan of Work prepared by the advisory committee with the student and submitted in quadruplicate to the department head and the Graduate School for approval as soon as feasible after completion of 12 hours of course work.
11. Three copies of the approved Plan of Work returned to the department. One copy is kept in department files, one is returned to the committee chair and one is given to the student.
12. Student passes language examination(s). (See page 53.)
13. Written examinations in the major and minor fields are scheduled no earlier than the end of the second year of graduate study and not later than one semester before the final oral examination. The results of these examinations will be reported to the Graduate School.

14. When all written examinations have been completed satisfactorily, the chair requests the scheduling of the preliminary oral examination at least two weeks prior to the suggested date. Upon approval of the request, a graduate faculty member is selected to represent the Graduate School at the examination, and the student and examining committee are notified of the time and place. The report of the examination is sent to the Graduate School and if the examination has been passed without conditions, the student is admitted to candidacy.
15. A copy of the preliminary draft of the dissertation is submitted to the chair of the student's advisory committee for review.
16. The diploma order request form must be filed with the Graduate School by the end of the third week of the semester or summer session of anticipated graduation. Failure to submit the form by this date may result in the student's not receiving the diploma at graduation.
17. At least two weeks prior to the final oral examination, the chair of the student's advisory committee submits the dissertation to advisory committee members for review.
18. One semester or its equivalent after admission to candidacy or later, permission for the candidate to take the final oral examination is requested of the Graduate School by the chair of the candidate's advisory committee. Requests should be filed at least two weeks before the date of the examination and must be accompanied by a certification that the dissertation is complete except for such revisions as may be necessary as a result of the final examination. Upon approval of the request, the student and the examining committee, including a Graduate School representative, are notified of the time and place of the examination. The Graduate School Representative receives a copy of the dissertation at least one week prior to the examination.
19. Two copies of the dissertation signed by each member of the student's advisory committee and five copies of the abstract must be submitted to the Graduate School by a specific deadline in the semester or summer session in which the degree is to be conferred. Specific deadline dates appear in The Calendar. Two copies of the University Microfilms Agreement and two copies of the Survey of Earned Doctorate forms must be submitted with the dissertation.
20. The dissertation is reviewed by the Graduate School to insure that the format conforms with the specifications prescribed in the *Guide for the Preparation of Theses*.
21. All course work scheduled in a graduate degree classification must be completed prior to graduation.
22. A grade point average of at least 3.0 is required for graduation.
23. The statute of limitations for completion of degree requirements is described on page 56.



FIELDS OF INSTRUCTION

The course descriptions are planned for the academic years 1984-1985 and 1985-1986, unless indicated otherwise. Some listed courses may not be taught, however, if registration for a course is insufficient, or if faculty or facilities are not available.

Consent of the department is required for all practicum and individual special topics or special problems courses as well as internships and thesis or dissertation research.

In a typical course description, the semester hours of credit, the number of actual lecture and laboratory hours of meeting per week and the term or terms in which the course is offered are shown in this manner: 2(1-2) F,S,Sum. or 1-3 F,S,Sum.

In the first example, the "2" indicates the number of semester hours credit given for satisfactory completion of the course. The "(1-2)" indicates that the course meets for one hour of lecture and two hours of laboratory work each week. In the second example, the "1-3" indicates that a maximum of three and a minimum of one semester hours' credit can be earned. This is to be arranged with the instructor. The "F" designates that the course is to be given in the fall semester. Likewise, the "S" designates spring and the "Sum.," summer.

Abbreviations used in the course listings are: CI, consent of instructor; PBS, Post-Baccalaureate Studies status; grad. standing, admitted to the Graduate School; undergrad., undergraduate; sr., senior; jr., junior; preq., prerequisite; coreq., corequisite; lab., laboratory; lect., lecture; and alt. years, alternate years.

Courses at the 600-level are not ordinarily open to undergraduates, although occasional exceptions are made for senior honor students.

For 400-level course descriptions, see the Undergraduate Catalog.

Adult and Community College Education

GRADUATE FACULTY

Professor E. J. Boone, Head

Professor R. W. Shearon, Associate Head

Professors: W. L. Carpenter, G. L. Carter Jr., R. D. Mustian; *Extension Professor:* D. R. Proctor; *Adjunct Professor:* I. E. Ready; *Professors Emeriti:* M. P. Burt, J. D. George, M. S. Knowles; *Associate Professors:* G. J. Andrews, J. C. Glass Jr., J. W. Wright; *Associate Professors Emeriti:* W. L. Gragg, E. E. White; *Assistant Professors:* D. F. Campbell, A. Fingeret, R. T. Liles, A. Malinowski

The department is a component of both the School of Education and the School of Agriculture and Life Sciences. It offers programs of study leading to the Master of Education, Master of Science and Doctor of Education degrees with a major in adult and community college education. The program is directed toward administrators, supervisors and teachers in cooperative extension and community colleges and other adult education agencies.

The department's curriculum is interdisciplinary. It is specifically designed to help students acquire an integrated conceptual and theoretical framework derived from the behavioral and social sciences and education that will equip them to plan, administer and effect viable and relevant programs of change with individual learners, groups and larger societal aggregates in both formal and informal settings.

Further, the curriculum provides opportunities for students to acquire a high level of competence in identifying and diagnosing problematic situations and in proposing alternative courses of action and strategies in seeking solutions to problems. Cognate fields of study include anthropology, economics, politics, psychology and sociology.

The department is housed in Ricks Hall and Poe Hall. Graduate students on assistantships and internships are provided office space and equipment. Other graduate students are provided study space when possible.

For descriptions of the adult and community college education courses listed below, see education.

SELECTED ADVANCED UNDERGRADUATE COURSE

ED 478 Extension as Non-formal Education. *Prq.: Advanced undergrad. or PBS. 363-00 S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

- ED 500** Community College and Two-year Postsecondary Education. *3(3-0) F,S.*
- ED 503** The Programming Process in Adult and Community College Education. *3(3-0) F,S.*
- ED 510** Adult Education: History, Philosophy, Contemporary Nature. *3(3-0) F,S.*
- ED 537** The Extension and Public Service Function in Higher Education. *3(3-0) F,Sum.*
- ED 538** Instructional Strategies in Adult and Community College Education. *3(3-0) F.*
- ED 539** Educational Gerontology. *3(3-0) S.*
- ED 543** Adulthood and Learning: The Later Years. *3(3-0) Alt. S.*
- ED 559** The Adult Learner. *3(3-0) S,Sum.*
- ED 567** Concepts and Strategies of Understanding, Motivating and Teaching Disadvantaged Adults. *3(3-0) S,Sum.*
- ED 579** Concepts and Principles of Evaluation Applied to Non-formal Adult Education. *3(3-0) S.*
- ED 585** Community Education. *3(3-0) S.*
- ED 596** Topical Problems in Adult and Community College Education. *Credits Arranged. F,S,Sum.*

FOR GRADUATES ONLY

- ED 600** Organizational Concepts and Theories Applied to Adult and Community College Education. *3(3-0) F,Sum.*
- ED 601** Administrative Concepts and Theories Applied to Adult and Community College Education. *3(3-0) S,Sum.*
- ED (PS) 607** The Politics of Higher Education. *3(3-0) S.*
- ED 696** Seminar in Adult and Community College Education. *1-3. F,S.*

Agricultural Communications

- AC 590** Special Topics in Agricultural Communications. *Preq.: Sr. or grad. standing. 1-6.* Special Topics may be selected for study in the theoretical approaches to communications problems or experimental investigation with instructor guidance. Graduate Staff

Agricultural Education

For a listing of graduate faculty and departmental information, see education.

Air Conservation

The air conservation faculty includes some 50 faculty members representing 20 departments in four schools. It is the intent of this faculty and the associated program to provide training for students in the many disciplines related to air conservation. Such areas as air sampling, biological effects, air-quality management, sources, meteorology, law and economics and business are all important aspects covered by course offerings and research projects.

A graduate student desiring to minor in air conservation will have on his or her committee a member of the air conservation faculty from outside the individual's major department, representing this minor field. While there are no restrictions on the major, students minoring in air conservation should have a strong background in the life sciences, the physical sciences or engineering. The minor program will normally consist of 9 or more credits for the master's degree, 15 or more for the doctorate.

A variety of courses bearing on different aspects of the air conservation problem may be taken on this campus, at UNC-Chapel Hill or at Duke. The listing below shows relevant courses available at North Carolina State University. For courses at Duke and Chapel Hill see the appropriate catalogs.

Air Pollutants and Their Sources

CE 576 Atmospheric Pollution.

Meteorology and Pollutant Transport

MEA 555 Meteorology of the Biosphere.

MEA 556 Air Pollution Meteorology.

MEA 627 Atmospheric Turbulence and Diffusion.

Air Sampling and Analysis

ST 511 Experimental Statistics for Biological Sciences I.

ST 515 Experimental Statistics for Engineers.

CH 517 Physical Methods of Elemental Trace Analysis.

Effects on Human, Animal and Plant Receptors

FOR 353 Air Photo Interpretation and Photogrammetry.

ZO 400 Biological Issues in Human Ecology.

TOX 515 Environmental Toxicology.

BO 561 Physiological Ecology.

Air Quality Management

MAE 409 Particulate Control in Industrial Atmospheric Pollution.

WPS 525 Pollution Abatement in Forest Products Industries.

CHE 535 Engineering Economy in Air Pollution Control Systems.

MAE 570 Theory of Particulate Collection in Air Pollution Control.

Air Quality Law and Institutions

UNI 495 Special Topics in University Studies (Environment and Law).
PA 511 Public Administration.

Air Conservation Economics

EB 401 Economic Analysis for Non-Majors.
OR 501 Introduction to Operations Research.
EB 515 Environmental and Resource Policy.

Communications concerning the air conservation program, including inquiries from students wishing to minor in air conservation, should be directed to the Chairman, Air Conservation Faculty, Department of Chemical Engineering, P.O. Box 5035, North Carolina State University, Raleigh, North Carolina 27650.

Animal Science

GRADUATE FACULTY

Professor C. A. Lassiter, Head

Professors: R. F. Behlow, J. H. Britt, A. J. Clawson, D. G. Davenport, E. J. Eisen, L. Goode, R. W. Harvey, B. H. Johnson, W. L. Johnson, E. E. Jones, J. R. Jones, J. M. Leatherwood, J. G. Lecce, J. E. Legates, B. T. McDaniel, R. D. Mochrie, R. M. Myers, B. R. Poulton, A. H. Rakes, H. A. Ramsey, O. W. Robison, F. D. Sargent, J. C. Wilk; *Professors Emeriti:* E. R. Barrick, G. Hyatt Jr., I. D. Porterfield, F. H. Smith, L. C. Ulberg, G. H. Wise; *Associate Professors:* W. D. Armstrong, K. R. Butcher, E. V. Caruolo, R. G. Crickenberger, J. J. McNeill; *Associate Professor Emeritus:* E. U. Dillard; *Assistant Professors:* K. L. Bryant, W. J. Croom, K. L. Esbenschade, J. T. Keeton, R. L. McCraw, R. L. Nebel, K. R. Pond, J. W. Spears, M. W. Tess, L. W. Whitlow

ASSOCIATE MEMBERS OF THE DEPARTMENT

Professors: C. H. Hill, D. J. Moncol, S. B. Tove; *Professor (USDA):* J. C. Burns; *Assistant Professor:* M. D. Whitacre

The Department of Animal Science offers programs of graduate study leading to the Master of Agriculture, Master of Science and Doctor of Philosophy degrees. Animal science offers an opportunity for training in a diversity of basic sciences and the integration of such knowledge into the framework of a living system. Students may major not only in animal science but also in any one of the following disciplines: biochemistry, genetics, microbiology, nutrition and physiology. Animal science majors may specialize in one or more of these basic disciplines or in the more applied areas of management and production. The animal science major provides for the student who prefers a multidisciplinary approach. Majors in a basic discipline are not only educated in it but have the added capability of in-

tegrating such knowledge into a living system, *i.e.*, the domestic animal. Minors can be obtained in any of the disciplines listed or in a variety of other areas.

Modern laboratories, specialized equipment and many different species of animals are available as research tools. A program of course work and a research project are developed for each student in accord with one's educational objectives. The primary goal is to provide the student with a challenging opportunity to develop his or her creative ability so that it may contribute significantly to a chosen discipline.

SELECTED ADVANCED UNDERGRADUATE COURSES

ANS 401 Reproductive Physiology. *Preq.: ZO 421. 3(2-3) F.*

ANS 402 Beef Cattle Management. *Preq.: ANS 204. 3(2-3) S.*

ANS 403 Swine Management. *Preq.: ANS 204. 3(2-3) F.*

ANS 404 Dairy Cattle Management. *Preq.: ANS 204. 3(2-3) S.*

ANS 405 Lactation. *Preq.: ZO 421. 3(2-3) S.*

ANS 406 Sheep Management. *Preq.: ANS 204. 3(2-3) S. Alt. yrs.*

ANS (FS) 409 Meat and Meat Products. *Preq.: CH 220. 3(2-3) S.*

ANS 410 Horse Science. *Preq.: ANS 310 or CI. 3(2-2) S.*

ANS 411 Breeding and Improvement of Domestic Animals. *Preq.: GN 411. 3(3-0) F.*

ANS (PO, NTR) 415 Comparative Nutrition. *Preq.: CH 220 or both 221 and 223. 3(3-0) F.*

ANS (NTR) 419 Human Nutrition in Health and Disease. *Preqs.: ANS (NTR, PO) 415 or FS 400, BCH 451. 3(3-0) S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ANS 500 Advanced Ruminant Nutrition. *Preq.: ANS 204 or ANS 415. 3(3-0) Alt. Sum.* Advanced concepts in ruminant nutrition for the practicing agricultural professional. Protein, energy, vitamin and mineral nutrition in relationship to the nutritional needs and practical feeding of beef cattle, dairy cattle, sheep and goats. New developments in feeding systems, feed additives and the prevention and treatment of metabolic disorders.

Crickenberger, Croom, Whitlow

ANS (PHY) 502 Reproductive Physiology of Vertebrates. *Preq.: ZO 421. 3(3-0) S.* Emphasis will be placed on discussions of mechanisms which control the reproductive processes. Mechanisms which are species-limited will be compared with those which are shared by all species. Current knowledge of some subsystems will be investigated in detail while others will be referred to in reviews of well-documented research findings.

B. H. Johnson

ANS (GN) 508 Genetics of Animal Improvement. *Preqs.: GN 411, ST 511. 3(3-0) S.* Emphasis is placed on the utilization of basic principles of population and quantitative genetics in animal improvement. Factors affecting genic and genotypic frequencies and

methods of estimating genetic and nongenetic variance, heritabilities and breeding values are presented. The roles of mating systems and selection procedures in producing superior genetic populations are examined. Robison

ANS 510 Advanced Livestock Management. *Preq.: ANS 402 or ANS 403 or ANS 404. 3(3-0) S.* An advanced study of beef cattle, dairy cattle and swine management practices with particular emphasis on input-output relationships and the consequences of alternative management decisions. Problem. (Offered on-campus in even-numbered years.) Davenport

ANS (NTR) 516 Quantitative Nutrition. *3(1-6) S.* (See nutrition.)

ANS 520 Tropical Livestock Production. *Preq.: Six hours of ANS at 400-level. 3(3-0) F.* Modern principles of feeding, genetics, forage production and management are applied to improvement of meat and dairy animals in tropical, subtropical and high-altitude environments. Considers biological and socio-economic constraints to development of livestock industry. Discussion of climatic effects on production applies to U. S. conditions and to developing tropical countries. W. L. Johnson

ANS (NTR) 540 Ruminant Physiology and Metabolism. *Preqs.: BCH 451 or 551, ZO 421. 3(3-0) F.* Detailed discussion of the ruminant digestive system, its dependent microbial fermentation and the unique aspects of ruminant tissue metabolism. Emphasis is given to the understanding of the interdependent relationship between the rumen microbial fermentation and the host animal's physiology and metabolism. The effects of changes in diet and physiological state and their relationship to various digestive and metabolic dysfunctions are discussed. Croom, McNeill

ANS (PHY) 580 Mammalian Endocrine Physiology. *Preqs.: BCH 451, ZO 421. 3(3-0) F.* Detailed discussion of the mammalian endocrine system with emphasis on the functional aspect, chemistry and mode of action of specific hormones secreted from major endocrine glands. Modern biochemical and physiological principles of hormonal integrations and neuroendocrine integration are examined. B. H. Johnson

ANS 590 Topical Problems in Animal Science. *Maximum 6 F,S.* Special problems may be selected or assigned in various phases of animal science. Graduate Staff

FOR GRADUATES ONLY

ANS (GN) 603 Population Genetics in Animal Improvement. *Preqs.: ST 512, GN 506. 3(3-0) F.* A study of the forces influencing gene frequencies, inbreeding and its effects, and alternative breeding plans. Eisen

ANS (PHY) 604 Experimental Animal Physiology. *Preq.: ZO (PHY) 513 or equivalent. 4(2-4) S.* A study of the theories and techniques involved in the use of animals in physiological investigation with special emphasis on the diversity of physiological applications on this campus. Caruolo

ANS (NTR, PO) 605 Mineral Metabolism. *Preqs.: ANS (NTR, PO) 415 or BCH 551, BCH 451 and ZO 421. 3(3-0) F.* Requirements, function, distribution, absorption, excretion and toxicity of minerals in humans and domestic animals. Interactions between minerals and other factors affecting mineral metabolism or availability. Emphasis on mechanisms associated with mineral functions and the metabolic bases for the development of signs of deficiency. Spears

ANS 690 Seminar in Animal Nutrition. *Preq.: Consent of seminar leaders. 1(1-0) F,S.* Orientation in philosophy of research, preparation for research and general research methodology. Graduate Staff

ANS 699 Research in Animal Science. *Credits Arranged. F,S.* A maximum of six hours is allowed toward the master's degree; no limitation on credits in doctorate program.

Graduate Staff

For related courses, see:

BCH 551 General Biochemistry I. *3(3-0) F.*

MB 551 Immunology I. *3(2-2) F.*

NTR 601 Protein and Amino Acid Metabolism. *3(3-0) S.*

NTR 608 Energy Metabolism. *3(3-0) F.*

Anthropology

For anthropology courses, see sociology and anthropology.

Architecture

GRADUATE FACULTY

Associate Professor R. P. Burns, *Acting Program Director*

Professors: P. Batchelor, G. L. Bireline Jr., R. H. Clark, C. E. McKinney, M. Pause, G. J. P. Reuer, H. Sanoff, V. F. Shogren, E. W. Taylor; *Professors Emeriti:* J. H. Cox, H. H. Harris, H. L. Kamphoefner, D. R. Stuart; *Associate Professors:* D. W. Barnes, J. P. Rand, P. Tesar, S. T. Wolfe; *Assistant Professors:* L. Sanders, J. Tector, E. F. Weinel

The graduate architecture program offers a student the opportunity to acquire the knowledge and skills necessary for private and public professional practice and for teaching and research. The Master of Architecture is a first professional degree program. As such, it satisfies the educational requirements for professional registration established by the various states and the National Council of Architectural Registration Boards.

One of the primary objectives of the program is to assist students in achieving a high level of excellence in architectural design. Architectural problems are encountered that require the acquisition of analytic, conceptual and developmental abilities. The *design studio* is the focus for this activity. It is the forum for students to test ideas and theories about design within the context of real life problems. Faculty and other resources are available for these problems of the built environment to be developed at a variety of scales and with special emphases: for example—product design, building design, urban design, community design and landscape design. The final semester in studio work is devoted to the development and presentation of a final design project of the student's own initiation and carried out with the guidance of his or her advisory committee.

Other course work supplements and amplifies these experiences. Courses are selected within the "major," architecture, and the "minor," any field other than architecture within the School or the University. The *technical professional*

courses—perception, man-environment, structures, professional practice, research methods—are developed as multidisciplinary courses within the School of Design or as specialized courses within the architecture program and are offered as “professional options.” *Design theory* courses provide an understanding of architecture through consideration of philosophical issues related to both the humanities and to technology. In addition, history-related courses provide an opportunity to understand the past as the context for the cultural values of the present. University-wide *complementary* courses are those relevant to the student’s program and outside the student’s major field of study (architecture), such as sociology, urban affairs, environmental technology, political science, construction management, business and administration and any others singly or in combination.

The School of Design provides a flexible curriculum in its graduate program in architecture; students have substantial freedom in individualizing their courses of study. It is therefore important that students exercise a high degree of initiative and responsibility in formulating and carrying out their educational goals. Options are normally selected with the advice of the student’s Graduate Advisory Committee.

The graduate architecture program is open to students holding: 1) four-year undergraduate, pre-professional degrees in architecture, 2) five-year professional degrees in architecture or 3) degrees in fields other than architecture.

For students holding four-year undergraduate degrees in architecture, the program requires a minimum of 48 credit hours of course offerings in the normal two-year master’s work: 24 credit hours of work will be in studio/workshops; 12 credit hours in professional options; and 12 credit hours in complementary university-wide courses. The program for graduates of a professional Bachelor of Architecture program requires a minimum of 30 credit hours of course work: 12 in studio, 6 in independent projects, 6 in professional options and 6 in complementary courses. The program for those with degrees in fields other than architecture can be designed to build on previous experience. The prerequisite “professional component” in the undergraduate program must be completed prior to achieving full graduate status, after which the normal 48 credit-hour master’s program is elected. A period of three and one half to four years in residence is normally required for students with degrees in fields other than architecture.

In addition to the usual University application procedures, a portfolio of design activity and interest is required. Those with degrees in fields other than architecture should not hesitate to apply and can indicate the nature and extent of related design activity and interests.

A major goal of this program is to produce graduates of sufficient intellectual breadth that they may go on to serve society in a wide variety of professional roles. Nevertheless, it is also specifically intended that a high proportion of graduates will seek out initial employment as professional assistant architects, that they will proceed further to obtain a professional license and that they will ultimately seek accomplishment at the highest levels of the architectural profession. The program-advising system has been instituted in part to assist students in establishing career directions.

SELECTED ADVANCED UNDERGRADUATE COURSE

ARC 400 Intermediate Architectural Design (Series). *Preq.: DF 102. May not be taken more than six times. 6(0-9) F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ARC 501 Professional Architecture Studio I. *Preqs.: BEDA degree or equivalent and CI; Coreq.: ARC 510. 6(0-12) F,S.* Design studio investigations aimed at the development of an understanding of the major issues confronting the contemporary architect and at the expanding of problem solving abilities in architectural design.

ARC 502 Professional Architecture Studio II. *Preqs.: ARC 501; ARC 510 and CI. 6(0-12) F,S.* Design investigations aimed at the development of an understanding of the major issues confronting the contemporary architect and at the expanding of problem solving abilities in architectural design. This is an individualized, final project studio.

ARC 510 Architectural Design Project Preparation. *Preqs.: BEDA degree or equivalent and CI. 3(3-0) F,S.* A seminar course designed to assist students to prepare the groundwork for the final project to be carried out in the design studio.

ARC 511 Professional Practice I. *Preq.: Fourth year standing. 2(2-0) F.* The evolution of architecture as a modern practical profession; obligations of the profession to society and to itself; the legal and ethical position of the architect in practice; comparative study of documents; the architect's working organization; emerging techniques of office practice.

ARC 512 Professional Practice II. *Preq.: Fourth year standing. 2(2-0) S.* Continuing study of standard documents and emerging techniques of practice, with emphasis on the principles and improved techniques of writing construction specifications; interrelationship of The Contract Documents; comparative study of techniques for controlling competitive bidding.

ARC 521, 522 Advanced Architectural Structures I, II. *Preq.: (521) DN 352; (522) ARC 521. 3(3-0) F,S.* Gravity and non-gravity loads on structures; comparative behavior of structural materials; comparative behavior of simple structural systems; approximate and exact analysis procedures as applied to systems; principles of approximate and exact design in timber, steel and reinforced concrete; architectural/structural/mechanical compatibility in systems; basic principles of foundation analyses and design.

ARC 531, 532 Advanced Building Technology I, II. *Preqs.: DN 253, 254. 2(1-3) F,S.* A synthesis of studies in building science undertaken in previous courses. Material assemblies in practical applications, dimensional characteristics of mechanical and construction systems for buildings, and special projects in selected areas of building science.

ARC 542 Investigations in Recent World Architecture. *Preq.: CI. 3(2-1) F.* A lecture-seminar course intended to provide a description and analysis of recent developments in architectural design through an examination of projects by many of the world's most important architects. Primary emphasis will be placed on emerging design concepts and theories as expressed in the built architecture and the visionary proposals of the past two decades.

ARC 543 Analysis of Precedent. *Preq.: Grad. standing or CI. 3(0-3) S.* The investigation of architectural elements, relationships, and ordering ideas through a comparative graphic examination and analysis of the work of architects. Emphasis on buildings as physical artifacts.

ARC 544 Architectural Conservation. *Preq.: Advanced undergrad. in SOD or grad. standing. 3(3-0) Alt. S.* An examination of the many dimensions of architectural conservation and/or preservation as a significant aspect of architectural practice. Historical evolution,

regulatory and economic factors, technology and pertinent design issues will be explored as foundations for individual case studies by class members of selected adaptive use, rehabilitation and restoration projects.

ARC 551 Design Methods and Programming. *Preq.: Grad. standing. 3(3-0) F.* The focus of this course is the exploration of concepts and techniques suitable for use in design problem-solving situations. One component of the course is devoted to a rationale for systematic inquiry and its link to creative problem solving. The second component will examine various process models leading to the design program which has been described as first generation methodology. The final component of the course will examine program methods which extend design thinking toward over-participation techniques.

ARC 570 Theory of Urban Form. *Preq.: Advanced undergrad. 3(3-0) Alt. F.* Survey of interdisciplinary theory of urban growth and evolution with about one half of the class period devoted to historical development of theory, and the other half devoted to contemporary quantitative models of urban form.

ARC 571 Urban Housing. *Preq.: Advanced undergrad. 3(3-0) S.* A lecture-seminar course intended to reveal the interrelationships between the form of housing and the processes of urban evolution, and to explore housing design as a function of economic, public policy, social and technological influences. Emphasis is placed on the physical form of housing through developments in the latter half of the twentieth century.

ARC 572 Urban Programming. *Preq.: Grad. standing or CI. 3(3-0) Alt. F.* This course is designed to reveal the programmatic requirements of communities in terms of density, size, physical structure and evolutionary characteristics. It is based on the analysis of social and economic characteristics of urban populations, and provides the designer and planner with estimates of the projected demand for facilities and services.

ARC 573 Environmental Perception. *Preq.: Grad. standing or CI. 3(3-0) S.* The course is designed to acquaint the student with the theories and research on the perception of urban environments. Emphasis is placed on the visual attributes as well as user perceptions of the environment with a focus on the structuring of research to explore these dimensions.

ARC 574 Place and Place Making. *Preq.: Grad. standing or CI. 3(3-0) F.* A seminar-lecture course which examines the definitions, concepts and emergent research findings that are useful in explaining the human sense of place. Particular emphasis is placed upon those physical aspects and relationships which influence this sense of place and over which the designer has some control.

ARC 581, 582 Conceptual Issues in Architecture and Design. *Preq.: Grad. standing or advanced undergrad. 3(3-0) F,S.* Fall semester—An examination and dialogue concerning current issues in American and Western society and their relation to the activities and goals of architects and designers. Spring semester—An investigation into issues and values currently held by participating students and their relation to an anticipated career in architecture and design.

ARC 591 Special Seminar. *Preq.: Grad. standing. 1-3 F,S.* Seminars on subjects of current interest in design which are presented by persons not part of the regular faculty.

ARC 592 Special Topics. *Preq.: Grad. standing. 2-3 F,S.* Topics of current interest to the programs in the School of Design offered by faculty in the School. Subjects offered under this number are normally used to test and develop new courses.

ARC 595 Independent Study. *Preq.: Grad. standing. 1-3 Max. 6. F,S,Sum.* Special problems in various aspects of design developed under the direction of a faculty member on a tutorial basis.

FOR GRADUATES ONLY

ARC 600 Advanced Architectural Design (Series). *Preq.: 24 hours ARC 400 or equivalent. 6(0-12) F.S.* Advanced studies in architectural design in which are investigated large-scale architectural problems having complex functional, social and economic implications leading to a synthesizing of all previous design experience through in-depth investigations of significant architectural environmental problems. Early emphasis is given to problem identification, program formulation and design application; consultation with planners and environmental specialists is extensive. A final project is developed in the last semester.

ARC 621, 622 Advanced Architectural Structures III, IV. *Preq.: (621) ARC 522; (622) ARC 621. 2(1-3) F.S.* Special projects in the study of complex structural systems: cable structures, membranes, thin shells, folded plates, arches, vaults, space frames; studies of construction techniques, prefabrication, structural behavior and stress analysis through model work and simplified calculation procedures.

ARC 691, 692 Special Topics in Architecture. *Preq.: Grad. standing. 1-6 F.S.* An investigation of special topics in architecture of particular interest to advanced students under the direction of a faculty member on a tutorial basis. Credits and content will vary with the needs of students.

Biochemistry**GRADUATE FACULTY**

Professor S. B. Tove, Head

Professors: F. B. Armstrong, H. R. Horton, J. S. Kahn, I. S. Longmuir, A. R. Main, E. C. Sisler, E. C. Theil; Associate Professors: J. A. Knopp, W. L. Miller—Graduate Administrator

ASSOCIATE MEMBERS OF THE DEPARTMENT

Professors: L. W. Aurand, E. E. Jones, H. E. Swaisgood

The field of biochemistry applies and extends the concepts of chemistry and physics to the investigation of biological problems. The Department of Biochemistry offers courses of study leading to the Master of Science and Doctor of Philosophy degrees.

A student entering graduate study in biochemistry should have a bachelor's degree in chemistry or in a biological science. The undergraduate program of study should have included a minimum of two semesters of organic chemistry, two semesters of physical chemistry, one semester of quantitative analytical chemistry and one semester of qualitative organic analysis. New students entering degree programs take placement examinations in organic and physical chemistry to determine their level of competence in these areas. Students who lack undergraduate courses considered essential for graduate study in biochemistry may be admitted to the graduate program, provided the deficiencies are corrected early in their graduate work.

Courses in general and experimental biochemistry are required as part of programs leading to advanced degrees in biochemistry. Other courses in biochemistry and related areas are required as recommended by the student's advisory committee. In addition, the student is expected to participate regularly in seminars, gain teaching experience, and pass a specified number of short written examinations (cumulative examinations), which are given semi-monthly throughout the academic year. Completion of a thesis based on original research is required for both the Master of Science and Doctor of Philosophy degrees, and a reading knowledge of one foreign language is required for the doctoral degree. Research programs are currently being conducted in biochemical genetics, enzyme structures and mechanisms, biochemical aspects of toxicology, regulation of metabolism, fluorescence spectroscopy of proteins and nucleic acids, enzyme kinetics, photosynthesis and electron transport, molecular interactions of ethylene in plants and developmental biochemistry of plants, lipid metabolism, nucleic acid metabolism, oxygen transport mechanisms, developmental changes in red blood cells and iron metabolism, bio-oxidation of lipids and foods, immobilization of enzymes and biomolecules, mechanisms of hormone action and disulfide bond formation in proteins and peptides.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

BCH 551 General Biochemistry I. *Preq.: Three years of chemistry including CH 223 or equivalent; one semester of physical chemistry would be helpful and one semester of undergraduate biochemistry strongly recommended. 3(3-0) F.* Protein structure and function, carbohydrate metabolism and the production of chemical energy, lipids and membrane structure and function, nucleic acids and protein metabolism. Jones

BCH 552 Experimental Biochemistry. *Preqs.: CH 223; CH 315 recommended; Preq. or Coreq.: BCH 551. 3(1-6) F.* An advanced laboratory designed to give students practical experiences in purification and quantitative characterization of enzymes and nucleic acids. Studies with carbohydrates and membrane lipids will also be included. Miller

BCH (PHY) 553 Physiological Biochemistry. *Preq.: BCH 551. 3(3-0) S.* Application of biochemical methods to the elucidation of the function of whole organisms. A. Biochemistry of 1) blood, 2) water, electrolyte, acid-base balance, 3) renal function, 4) muscle metabolism, 5) central nervous system, 6) autonomic nervous system, 7) endocrine system. B. Biochemistry of adaptation to environment: 1) high and low P_{O_2} , 2) hot and cold, 3) wet and dry, 4) pollution. Longmuir

BCH 554 Radioisotope Techniques in Biology. *Preq.: BCH 451 or CI. 2(1-3) S, Sum.* Theory and application of radioisotope techniques used in biology. The different modes of radioactivity are correlated with methods of measurement. Emphasis on use and limitations of various instruments and techniques and on their application to research problems. Sisler

BCH 557 Introductory Enzyme Kinetics. *Preqs.: BCH 551 and MA 201 or 212. 3(3-0) Alt. F.* Basic principles of chemical kinetics are applied to develop enzyme kinetics. Limitations of the Michaelis equation are considered in light of the general rate equation. Transient state

kinetics are then considered. Inhibition and activation, pH functions, effects of temperature, and elucidation of mechanisms follow. The kinetics of allosteric site interactions and of conformational forms complete the course. (Offered 1984 and alt. years.) Main

BCH (GN) 561 Biochemical and Microbial Genetics. *Preqs.: BCH 451 or 551, GN 411 or 505, MB 401 or equivalent. 3(3-0) S.* A study of the development of the fields of biochemical and microbial genetics, emphasizing both techniques and concepts currently used in molecular research. Includes lectures and discussions of current research publications.

Armstrong

BCH 590 Special Topics in Biochemistry. *Preq.: BCH 451 or equivalent. Credits arranged, Max. 3 F,S,Sum.* The study of topics of special interest by small groups of students instructed by members of the faculty. Graduate Staff

FOR GRADUATES ONLY

BCH 651 Physical Biochemistry. *Preq.: BCH 551. 3(3-0) Alt. F.* Structural and physical properties of biological macromolecules and the application of spectroscopic methods to their study. (Offered 1985 and alt. years.) Knopp

BCH 652 Biochemical Research Techniques. *Preq.: BCH 551 and CH 431 or CI. 3(1-6) Alt. S.* Theory and interpretation of physical measurements of macromolecular structure with particular emphasis given to analysis of interactions of proteins. Laboratory experiments demonstrate transport and equilibrium properties of interacting proteins: multiple binding equilibria, difference spectroscopy, analytical gel chromatography, affinity chromatography, electrophoresis, velocity sedimentation and equilibrium ultracentrifugation. (Offered 1984 and alt. years.) Swaisgood

BCH 653 Biochemistry of Hormone Action. *Preq.: BCH 551. 3(3-0) Alt. S.* Well defined models of steroid and protein hormone action are studied via lectures, assigned readings and discussions. Students add breadth to the course and depth to their own understanding by searching the literature and writing or lecturing about a particular hormone of their own choosing. (Offered 1985 and alt. years.) Miller

BCH 655 General Biochemistry II. *Preq.: BCH 551. 3(3-0) S.* A continuation of BCH 551 with emphasis on enzyme kinetics, allosterism and cooperativity, micelles and biological membranes, bioenergetics and metabolism of carbohydrates and lipids. Tove

BCH 657 General Biochemistry III. *Preq.: BCH 551. 3(3-0) F.* A continuation of BCH 551 with emphasis on enzyme mechanisms, relation of enzyme structure to catalytic mechanisms and specificity, structure and function of nucleic acids, metabolism of nitrogenous biomolecules and modes of metabolic regulation. Horton

BCH (CH) 659 Natural Products. *3(3-0) F.* (See chemistry.)

BCH 691 Seminar in Biochemistry. *1(1-0) F,S.*

Graduate Staff

BCH 695 Special Topics in Biochemistry. *Preq.: Grad. standing in BCH. Credits Arranged. F,S,Sum.* Critical study of special problems and selected topics of current interest in biochemistry and related fields. Graduate Staff

BCH 699 Biochemical Research. *Credits Arranged, F,S,Sum.*

Graduate Staff

Biological and Agricultural Engineering

GRADUATE FACULTY

Professor F. J. Hassler, Head

Professors: H. D. Bowen, B. K. Huang, F. J. Humenik, E. G. Humphries, W. H. Johnson, G. J. Kriz, W. F. McClure, R. P. Rohrbach, R. W. Skaggs, R. E. Sneed, R. S. Sowell, C. W. Suggs, E. H. Wiser, J. H. Young; *Professors (USDA):* J. W. Dickens, T. B. Whitaker; *Professor Emeritus:* D. H. Howells; *Associate Professors:* C. F. Abrams, G. R. Baughman, L. M. Safley Jr., P. W. Westerman, D. H. Willits; *Extension Associate Professor:* J. C. Barker; *Assistant Professor:* C. G. Bowers Jr.; *Senior Researcher:* S. C. Mohapatra

ASSOCIATE MEMBERS OF THE DEPARTMENT

Professors: D. D. Hamann, A. E. Hassan, V. A. Jones

The Department of Biological and Agricultural Engineering offers programs of study for the Master of Science, Doctor of Philosophy and Master of Biological and Agricultural Engineering degrees.

In the Master of Science program emphasis is placed on mathematics and theory as the unifying link between otherwise divergent fields of knowledge in the biological and physical sciences and as prerequisites to effective engineering advances in biological and agricultural areas. As the student acquires competence in the advanced methods of science, he or she applies knowledge by conducting an original research investigation and by writing and defending a thesis.

Study for the Doctor of Philosophy degree builds on the Master of Science program with additional formal study followed by a period of independent dissertation research.

Current departmental research projects available for graduate student participation include animal waste treatment and recycling systems, instrumentation to measure quality and composition of agricultural commodities, mechanization of field and horticultural crops (tobacco, sweet potatoes, cucumbers, blueberries, grapes, ornamental plants, floral crops, and greenhouse vegetables), peanut and tobacco processing, drainage and water table control systems, hydrologic models for agriculture, poultry production systems, occupational safety and health in agriculture and production systems for cotton, soybeans, tobacco, sweet potatoes, peanuts and floral crops.

For those interested primarily in a broadened background of engineering science and technology—without the thesis requirement—the Master of Biological and Agricultural Engineering program permits a wide selection from a variety of advanced courses. While this program is primarily for those intending to terminate graduate study at the master's level, a student may, with departmental approval, develop a plan of study under this program which leads to study for the doctorate.

Graduate students have access to modern well-equipped research laboratories, controlled environment test chambers, excellent computing facilities and a research shop manned by competent mechanics.

Information concerning fellowships and assistantships may be obtained from the department head.

SELECTED ADVANCED UNDERGRADUATE COURSES

BAE 411 Farm Power and Machinery. *Preqs.: BAE 211, CH 101, PY 211 or 221. 3(2-3) S.*

BAE 461 Analysis of Agricultural Systems. *Preqs.: MA 114 or 112, EB 212. 3(2-2) F.*

BAE 462 Functional Design of Field Machines. *Preq.: BAE 361; Coreq.: ST 361. 3(2-3) S.*

BAE (CHE) 465 Introduction to Biomedical Engineering. *Preqs.: MA 202 or 212 or PY 212 or 208. 3(3-0) S.*

BAE 471 Soil and Water Engineering. *Preqs.: BS 100, SSC 200, MAE 308. 4(3-2) F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

BAE 552 Instrumentation for Agricultural Research and Processing. *Preqs.: EE 331, MA 301. 2(1-3) Alt. F.* Theory and application of primary sensing elements and transducers. Generalized performance characteristics and the use of standards. Use of specialized measurement systems for agricultural research and processing including an introduction to correlation and power spectral density measurements. McClure

BAE (CE, MB) 570 Sanitary Microbiology. *3(2-3) S.* (See civil engineering.)

BAE (CE) 578 Agricultural Waste Management. *Preq.: Grad. or advanced undergrad. standing. 3(2-3) Alt. F.* A study of agricultural and associated processing wastes. Special laboratory techniques required for the characterization of these wastes will be emphasized. Principles and examples considered will be utilized to develop waste management and non-destructive waste utilization systems that are integral to the total operation. Barker

BAE (FS) 585 Biorheology. *Preqs.: PY 205, MAE 314. 3(2-2) F.* The concepts of strain, stress and the mechanical viscoelastic properties of biological solids, fluids and slurries. The time-dependent deformation and flow of bio-materials elements of strength of materials, rheological equations and model concepts, creep-relaxation and dynamic behavior, contact problems and the Boltzmann superposition principle as a function of time, temperature and moisture content. Hamann

BAE 590 Special Problems. *Preq.: Sr. or grad. standing in biological and agricultural engineering. Credits Arranged.* Each student will select a subject on which to do research and write a technical report on the results. The individual may choose a subject pertaining to his or her particular interest in any area of study in biological and agricultural engineering. Graduate Staff

FOR GRADUATES ONLY

BAE 654 Nonequilibrium Thermodynamics in Bioengineering. *Preq.: MA 511. 3(3-0) Alt. S.* Generalized classical thermodynamics is extended by Onsager's relations to provide a theoretical basis for analyzing the energetics of systems that include life processes. Topics il-

illustrate applications to special systems including isothermal diffusion and sedimentation, membrane permeability, transport processes in continuous systems and systems with temperature gradients. Graduate Staff

BAE 661 Analysis of Function and Design of Biological and Physical Systems. *Preq.: CI. 3(2-3) Alt. F.* Mathematical and analytical techniques and principles essential in the analysis and design of machines and systems which encompass both the biological and the physical domains and their interfaces. Analytical treatment of physical and biological systems and the functional analysis of machine components are studied to bridge the gap between theories and applications. Control systems synthesis and design are treated with emphasis on quantitative dynamic relations between elements and system response using transfer function and computer simulation techniques. Bowen, Huang

BAE (SSC) 671 Theory of Drainage—Saturated Flow. *Preq.: MA 301. 3(3-0) Alt. F.* Physical concepts and properties of fluids and porous media are discussed in relation to soil-water movement. The fundamental laws and equations governing saturated flow in porous media are derived and discussed. Mathematical solutions of steady-state and transient flow equations are analyzed to determine their applicability to drainage problems. Analogs and models of particular drainage problems are considered. Skaggs

BAE (SSC) 674 Theory of Drainage—Unsaturated Flow. *Preq.: BAE 671 or equivalent. 3(3-0) Alt. S.* Forces involved and theories utilized in saturated flow of porous media are discussed in relation to soil moisture movement. Steady-state and transient unsaturated flow equations for horizontal and vertical moisture movement are developed and solved. The solutions are applied to present day laboratory and field technology. Molecular diffusion and hydrodynamic dispersion are considered in light of current tracing techniques. Skaggs

BAE 690 Special Topics. *Preq.: Grad. standing. 1-4.* A study of topics in the special fields of interest of graduate students under the direction of the graduate faculty. Graduate Staff

BAE 695 Seminar. *Preq.: Grad. standing in BAE. 1(1-0) F,S.* Elaboration of the subject areas, techniques and methods peculiar to professional interest through presentations of personal and published works; opportunity for students to present and critically defend ideas, concepts and inferences. Discussions to point up analytical solutions and analogies between problems in biological and agricultural engineering and other technologies, and to present the relationship of biological and agricultural engineering to the socio-economic enterprise. Sowell

BAE 699 Research in Biological and Agricultural Engineering. *Preq.: Grad. standing in BAE. Credits Arranged.* Performance of a particular investigation of concern to biological and agricultural engineering. The study will begin with the selection of a problem and culminate with the presentation of a thesis. Graduate Staff

Biological Sciences

Professor C. F. Lytle, Teaching Coordinator

There is no separate graduate major in the biological sciences, but several interdisciplinary courses are coordinated by the Biological Sciences Interdepartmental Program of the School of Agriculture and Life Sciences. These courses are applicable to several major and minor programs. Current courses include:

SELECTED ADVANCED UNDERGRADUATE COURSE

BS 491 Seminar on Professional Development in Biological Sciences. 1(1-0) F.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

BS 590 Special Problems in Biological Instrumentation. *Preq.: CI. 1-3 F.S.* Basic components of spectrophotometers including light sources, dispersing devices, detectors and read-out methods; theoretical and practical aspects of electron microscopy; basics of analog and digital computing methods and applications of computers to biological research; methods of separation and identification of bio-polymers; principles of measurement; the application of electronics in biological measuring and sensing devices; and human cytological techniques. Course consists of five-week modules (sections) devoted to specific types of instrumentation.

Graduate Staff

FOR GRADUATES ONLY

BS 690 Seminar in Cell Biology. *Preqs.: Grad. standing, background in biology or chemistry. 1(1-0) S.* A topical appraisal of current literature in selected areas of cell biology through presentations and discussions by students, faculty and visiting scientists.

Graduate Staff

BS 696 Topics in Biological Ultrastructure. *Preq.: Grad. standing (background preferably in biology). 1(1-0) F.* A survey of the ultrastructure of living organisms from viruses to higher plants and animals by means of illustrated lectures. The changes in fine structure associated with differentiating cells and with cells in various metabolic states are examined.

Graduate Staff

Biomathematics**GRADUATE FACULTY**

Professor H. J. Gold, Director

Professors: D. L. Ridgeway, H. R. van der Vaart, B. S. Weir; Adjunct Professor: M. W. Anderson; Professor Emeritus: R. J. Monroe; Associate Professors: K. H. Pollock, M. Wann

ASSOCIATE MEMBERS OF THE PROGRAM COMMITTEE

Professors: H. E. Schaffer, R. E. Stinner; Associate Professors: L. A. Real, J. F. Reynolds; Assistant Professor: J. M. Mahaffy

Biomathematics deals with the application of mathematical modeling to biological systems, as well as with the testing and validation of such models, and with the development of relevant theory. As conditioned by each student's interests, the program of study develops supportive competence in statistics, biology, physical science and mathematical science.

Students entering the Biomathematics graduate program are expected to have had advanced calculus, a course in linear algebra and a course in general biology. Deficiencies in any of these areas should be remedied during the first year.

The Biomathematics graduate program is administered as a division within the Department of Statistics, with associate faculty drawn from several other departments. Further information may be found in the description for the Department of Statistics. A brochure is available which describes the biomathematics degree requirements and research interests of the faculty.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

BMA 511 Introduction to Mathematical Modeling of Biological Systems. *Preqs.: MA 112 and graduate standing in a biological or related field. 3(3-1) S.* Intended primarily for students in the biological sciences. Topics include use of diagrams and flow charts in mathematical modeling, probabilistic and deterministic description of dynamic processes, feedback relations, steady states and homeostasis at the biochemical, physiological and ecosystem levels. Role of statistics and computer science in modeling. Examination of current literature. Gold

BMA (MA, ST) 571 Biomathematics I. *Preq.: Advanced calculus, reasonable background in biology or CI. 3(3-0) F.* The role of theory construction and model building in the development of experimental science. Induction vs. deduction. The historical development of mathematical theories and models for the growth of one-species populations (logistic and offshoots), including considerations of age distributions (matrix models, Leslie and Lopez; continuous theory, renewal equations. Some of the more elementary theories on the growth of organisms (von Bertalanffy, with applications to ecology; allometric theories, cultures grown in a chemostat). Mathematical theories of two and more species systems (predator-prey, competition, symbiosis; according to the Volterra-Lotka schemes, leading up to present-day research), and discussion of some related models for chemical kinetics. Much emphasis is placed on scrutiny of the biological concepts as well as of the mathematical structure of the models in order to uncover both weak and strong points of the models discussed. Mathematical treatment of the differential equations in these models stresses qualitative and graphical aspects, as well as certain aspects of discretization. van der Vaart

BMA (MA, ST) 572 Biomathematics II. *Preqs.: BMA 571, elementary probability theory. 3(3-0) S.* Continuation of topics of BMA 571. Some more advanced mathematical techniques concerning nonlinear differential equations of the types encountered in BMA 571: several concepts of stability, asymptotic directions, Liapunov functions. Comparison of deterministic and stochastic models for several biological problems including birth and death processes. Discussion of various other applications of mathematics to biology, some recent research. van der Vaart

BMA 591 Special Topics. *Preq.: CI. Maximum 3. F,S.* Directed readings, problem sets, written and oral reports as dictated by need and interest of student; new 500-level courses during the developmental phase. Graduate Staff

FOR GRADUATES ONLY

BMA 691 Advanced Special Topics. *Preq.: CI. 1-3 F,S.* Directed readings, problem sets, written and oral reports as dictated by need and interest of student; new 600-level courses during the development phase (currently includes courses in systems modeling theory, biophysical theory and in physical theory). Graduate Staff

BMA 694 Seminar. *Preq.: Grad. standing. 1(1-0) F,S.* Graduate students in biomathematics are expected to attend through most of their residence period. Graduate Staff

BMA 699 Research. *Credits Arranged. F,S.* Graduate Staff

Botany

GRADUATE FACULTY

Professor J. P. Miksche, Head

Professors: C. E. Anderson, U. Blum, R. J. Downs, R. C. Fites, J. W. Hardin, R. L. Mott, E. D. Seneca, E. C. Sisler, J. R. Troyer, A. M. Witherspoon; *Professors (USDA):* W. W. Heck, H. E. Pattee, H. Seltmann; *Professors Emeriti:* D. B. Anderson, G. R. Noggle, H. T. Scofield, L. A. Whitford; *Associate Professors:* R. L. Beckmann, J. F. Reynolds, J. M. Stucky, C. G. Van Dyke, T. R. Wentworth, T. E. Wynn—*Graduate Administrator; Associate Professor (USDA):* H. H. Rogers; *Assistant Professors:* H. V. Amerson, W. F. Boss, J. F. Thomas

ASSOCIATE MEMBERS OF THE DEPARTMENT

Professors: A. W. Cooper, B. J. Copeland, M. M. Goodman, R. J. Thomas, D. H. Timothy; *Professor (USDA):* D. E. Moreland; *Associate Professor:* R. L. Hoffman; *Associate Professor (USDA):* S. C. Huber; *Assistant Professor (USDA):* J. M. Anderson

The Department of Botany offers programs leading to the Master of Life Sciences (non-thesis), Master of Science and Doctor of Philosophy degrees.

Excellent physical facilities are available for instruction and research in all phases of the departmental program. The Phytotron (part of a two-unit controlled environment facility operated in collaboration with Duke University) offers opportunities for research in experimental taxonomy, ecology, morphology and plant physiology. The department supports a research program in plant cell and tissue culture. A herbarium supports studies in systematic botany, and is augmented by herbaria in the Departments of Botany at nearby Duke University and the University of North Carolina at Chapel Hill. Field laboratories are available at the coast, in the Piedmont and in the mountains. The department participates in tropical biology programs through university membership in the Organization for Tropical Studies.

All graduate students will participate at least one semester during a degree program in the departmental instructional program. Graduate students are expected to attend and participate in the seminar program every semester they are in residence.

SELECTED ADVANCED UNDERGRADUATE COURSES

BO 400 Plant Diversity. *Preq.: BO 200. 4(3-3) F.*

BO 403 Systematic Botany. *Preq.: BS 100 or 105 or BO 200. 4(2-4) S.*

BO 413 Introductory Plant Anatomy. *Preq.: BO 200 or equivalent. 3(2-3) S.*

BO (ZO) 414 Cell Biology. *Preqs.: CH 223, PY 212, ZO 201 or 203. 3(3-0) F.*

BO 421 Plant Physiology. *Preqs.: BS 100 or BS 105 or BO 200 and one year of college chemistry. 4(3-3) F,S.*

BO 480 Air Pollution Biology. *Preqs.: An introductory biology course and chemistry, jr. standing. 3(2-3) S.*

BO 499 Independent Study in Botany. *Preqs.: At least eight hours of Botany, advanced standing and presentation of plan of work approved by a faculty member. 1-3 F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

BO 510 Plant Anatomy. *Preq.: BO 200. 4(2-6) F.* A study of plant cells, ultrastructure, cell types, tissues, organs and patterns of growth and differentiation. (Offered 1985 and alt. years.)
Anderson

BO 522 Advanced Morphology and Phylogeny of Seed Plants. *Preq.: BO 403. 4(3-3) S.* A comprehensive survey of the morphology and evolution of angiosperms and gymnosperms. Special emphasis is given to vegetative and reproductive morphology of fossil and living forms, and to their presumed evolutionary relationships. (Offered 1984-85 and alt. years.)
Hardin

BO 524 Grasses, Sedges and Rushes. *Preq.: BO 403. 4(2-6) F.* A course dealing with three large, economically and ecologically important plant families. A working familiarity will be achieved through an introduction to the special terminology used in dealing with these plants, extensive field work emphasizing keying out plants collected and a study of the recently developed modern classification of the grasses. (Offered 1985-86 and alt. years.)
Stucky

BO (CS, ENT, PM, PP) 525 Biological Control. *4(3-3) Alt. F.* (See pest management.)

BO 544 Plant Geography. *Preqs.: BO 403, BO (ZO) 360, GN 411 or equivalents. 3(3-0) S.* A course in descriptive and interpretive plant geography, synthesizing data from the fields of ecology, genetics, geography, paleobotany and taxonomy. Includes a survey of the present distribution of major vegetation types throughout the world, a discussion of the history and development of this present pattern of vegetation and a discussion of the principles and theories of plant geography. (Offered 1985-86 and alt. years.)
Seneca

BO 551 Advanced Plant Physiology I. *Preqs.: General botany or biology and biochemistry. 3(3-0) F.* The first half of a two-semester sequence covering the field of plant physiology. Topics will include cellular transport, water relations, mineral relations, vascular transport and temperature relations.
Troyer

BO 552 Advanced Plant Physiology II. *Preqs.: General botany or biology, introductory physiology and biochemistry. 3(3-0) S.* The second half of a two-semester sequence covering the field of plant physiology. Topics will include respiration, photosynthesis, nitrogen metabolism, growth and development.
Boss

BO 553 Laboratory in Advanced Plant Physiology I. *Preq. or coreq.: BO 551. 1(0-3) F.* Laboratory to accompany BO 551 Advanced Plant Physiology I
Graduate Staff

BO 554 Laboratory in Advanced Plant Physiology II. *Preq. or coreq.: BO 552. 1(0-3) S.* Laboratory to accompany BO 552 Advanced Plant Physiology II
Graduate Staff

BO (ZO) 560 Principles of Ecology. *Preq.: Three semesters of college level biology courses. 4(3-3) F.* A consideration of the principles of ecology at the graduate level. Each of

the major subject areas of ecology is developed in sufficient depth to provide a factual and philosophical framework for the understanding of ecology. Blum

BO 561 Physiological Ecology. *Preqs.: BO 421 and BO (ZO) 560 or equivalent. 4(3-3) S.* The plant community is approached from a physiological standpoint. Emphasis will be placed on the individual in the community and how it responds to its immediate environment on short- and long-term bases. (Offered 1984-85 and alt. years.) Blum

BO 565 Plant Community Ecology. *Preq.: BO (ZO) 560 or BO (ZO) 360 or equivalent. 4(3-3) F.* Consideration of the structure and function of terrestrial vascular plant communities, with emphasis on classical and recent research. Topics include measurement and description of community properties, classification, ordination, vegetation pattern in relation to environment, ecological succession and a survey of the vegetation of North America. Wentworth

BO 570 Quantitative Ecology. *Preqs.: BO (ZO) 560 and ST 512 or equivalent. 3(3-0) F.* A course emphasizing the quantitative techniques and theories of vegetation analysis. Topics include sampling methodologies, the evaluation of sample adequacy, spatial patterns and species associations, the measurement and interpretation of ecological diversity, gradient analysis and classification of communities and plant population dynamics. Reynolds

BO (MB) 574 Phycology. *Preq.: BS 100 or BO 200. 3(1-4) S.* An introduction to the taxonomy, morphology, reproduction and ecological importance of organisms which may be included in the algae. Attention is given to the local freshwater flora and the physiology of selected species as it relates to algal blooms, water quality and nutrient loading in aquatic habitats. Witherspoon

BO (MB, PP) 575 The Fungi. *Preq.: BO 200 or equivalent. 3(3-0) F.* An overview of the fungi within the framework of a survey of the major classes. Van Dyke

BO (MB, PP) 576 The Fungi—Lab. *Coreq.: BO 575. 1(0-3) F.* Illustrative material of the fungal assemblages discussed in BO 575. Van Dyke

BO 590 Topical Problems. *Preq.: CI. 1-3 F,S.* Discussions and readings on problems of current interest in the fields of ecology, anatomy and morphology, taxonomy, plant physiology and cell biology. May be repeated with a change in topic for a maximum of six credits. Graduate Staff

FOR GRADUATES ONLY

BO 612 Plant Morphogenesis. *Preq.: Six hours of botany equivalent to BO 400 and BO 421. 4(3-3) S.* A review and synthesis of the factors involved in the development of plant form. Tissue culture experiments will demonstrate levels of control from the molecular to the whole organism. (Offered 1985-86 and alt. years.) Mott

BO 620 Advanced Taxonomy. *Preq.: BO 403. 4(2-6) S.* Principles and techniques including history of classifications, rules of nomenclature, literature, biosystematic methods, monographic techniques and concepts of categories. (Offered 1985-86 and alt. years.) Stucky

BO (PP) 625 Advanced Mycology. *4(2-6) F.* (See plant pathology.)

BO 631 Water Relations of Plants. *Preq.: BO 551 or equivalent. 3(3-0) S.* A discussion of the physiological water relations of plants with emphasis on theoretical principles and quantitative description. (Offered 1984-85 and alt. years.) Troyer

BO 633 Plant Growth and Development. *Preqs.: BO (ZO) 414 or BO 421, organic chemistry. 3(3-0) S.* An advanced course in plant physiology covering plant growth, development, differentiation, senescence and biological control mechanisms. Fites

BO 634 Introduction to the Thermodynamics of Biological Systems. *Preq.: BO 551 or CI. 3(3-0) S.* An introductory development of the thermodynamic theory relevant to biological systems together with consideration of examples of biological problems to which thermodynamic theory has been applied. (Offered 1985-86 and alt. years.) Troyer

BO 636 Discussions in Plant Physiology. *Preqs.: BO (ZO) 414 or BO 421, organic chemistry. 1(1-0) F,S.* Group discussions at an advanced level on selected topics. Graduate Staff

BO (ZO) 660 Advanced Topics in Ecology I. *Preq.: BO (ZO) 560. 4(3-3) S.* Subject matter in the major fields of ecology will be developed through seminars and lectures, and principles will be illustrated by laboratory exercises and field trips. Topics covered include microenvironment, population biology, community ecology, ecosystems and nutrient cycling. Graduate Staff

BO (ZO) 661 Advanced Topics in Ecology II. *4(3-3) S.* (See zoology.)

BO 662 Applied Coastal Ecology. *Preq.: BO (ZO) 360 or BO (ZO) 560. 3(3-0) S.* Course will cover the environmental factors, the vegetative communities, and man's influence on the ecology of the Coastal Plain of North Carolina. Emphasis will be placed on the coastal fringe (Outer Banks) and the problems involved in Coastal Zone Management. Course is field and problem oriented and is designed primarily for graduate students in environmentally-oriented programs. (Offered 1984-85 and alt. years.) Seneca

BO 691 Botany Seminar. *1(1-0) F,S.* Graduate Staff

BO 693 Special Problems in Botany. *Credits Arranged.* Directed research in some phase of botany other than a thesis problem, but designed to provide experience and training in research. Graduate Staff

BO 699 Research. *Credits Arranged. F,S.* Original research preliminary to writing a master's thesis or a doctoral dissertation. Graduate Staff

Chemical Engineering

GRADUATE FACULTY

Professor H. B. Hopfenberg, Head

Professors: R. M. Felder—Graduate Administrator, J. K. Ferrell, R. P. Gardner, W. J. Koros, D. B. Marsland, D. C. Martin, M. R. Overcash, R. W. Rousseau, E. P. Stahel, V. T. Stannett; Adjunct Professors: F. O. Mixon, D. R. Squire; Professors Emeriti: R. Bright, J. F. Seely, H. B. Smith; Associate Professors: P. S. Fedkiw, P. K. Lim, C. J. Setzer, H. M. Winston; Adjunct Associate Professors: T. R. Hauser, J. L. Williams; Assistant Professors: C. M. Balik, D. E. Guinnup, P. K. Kilpatrick

The Department of Chemical Engineering offers programs of advanced study leading to the Master of Science, Master of Chemical Engineering and Doctor of Philosophy degrees. Students enrolling for graduate study in the department normally have a bachelor's degree in chemical engineering, but programs can be arranged to accommodate students with degrees in applied mathematics, chemistry, physics and other branches of engineering.

The department occupies 50,000 square feet in the Riddick Engineering Laboratories. Within the building are several general-purpose laboratories for graduate research, fully staffed machine and electronics shops, and a well-equipped instrumental analysis laboratory. A pilot-scale fluidized bed coal gasifier and gas cleaning plant provides a unique facility for coal processing research, and pilot plants are also available for the study of heat transfer, reaction kinetics and mixing phenomena in polymerization reactors. A VAX 11-750 computer within the department and terminal links to larger mainframe computers provide rapid service on all digital jobs, and a Fisher Digital Control Center provides an excellent capability for studies of process control.

Extensive research in the department is carried out in the area of polymer science and engineering. Graduate and post-doctoral efforts in this field include studies of ionic and free-radical polymerization, grafting reactions, membrane technology and design of polymerization reactors. Other active research areas include pollution monitoring and control, coal gasification, chemical reaction engineering, fluid dynamics, separation processes—particularly crystallization, distillation and membrane separation techniques—heat transfer, process control and optimization, phase equilibrium thermodynamics, interfacial phenomena and biochemical engineering.

The proximity of UNC-Chapel Hill, Duke University and the Research Triangle Park lends considerable support to departmental research programs. The Environmental Protection Agency, for example, has its principal air pollution research facility in the Research Triangle Park, and arrangements can be made for graduate students studying air pollution problems to work at the EPA center under the joint direction of EPA and University staff members.

A brochure describing in greater detail opportunities for graduate study and research in chemical engineering as well as available fellowships and assistantships may be obtained upon request from the graduate administrator.

SELECTED ADVANCED UNDERGRADUATE COURSES

CHE 425 Process System Analysis and Control. *Preq.: CHE 225. 3(3-0) F.*

CHE 432 Chemical Engineering Lab III. *Preq.: CHE 330. 3(0-9) F,S.*

CHE 446 Design and Analysis of Chemical Reactors. *Preq.: CHE 315; Coreq.: CHE 316. 3(3-0) F.*

CHE 451 Chemical Engineering Design. *Preqs.: CHE 421, 446. 3(2-2) F,S.*

CHE (BAE) 465 Introduction to Biomedical Engineering. *Preqs.: MA 202 or 212, PY 212 or 208. 3(3-0) F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

CHE 511 Chemical Engineering Process Modeling. *Preqs.: CHE 311, CHE 327, MA 301. 3(3-0) F.* The application of the methods of mathematical analysis to the formulation and solution of problems in transport phenomena, process dynamics and chemical reaction engineering.
Fedkiw, Felder

CHE 513 Thermodynamics I. *Preqs.: CHE 315, 316. 3(3-0) F.* An intermediate course in the application of thermodynamic principles to problems arising in the chemical process industries. Chemical reactions and phase separation operations are viewed from a thermodynamic standpoint including consideration of their energy efficiencies.
Kilpatrick, Lim

CHE 515 Transport Phenomena. *Preqs.: CHE 311, 327. 3(3-0) S.* A theoretical study of transport of momentum, energy and matter with emphasis on the latter two. The diffusional operations are introduced in the light of the theory.
Carbonell, Lim

CHE 517 Kinetics and Catalysis. *Preq.: CHE 446. 3(3-0) F.* Rates of homogeneous and heterogeneous chemical reactions; experimental methods and mathematical techniques used in the acquisition and analysis of rate data and the design of chemical reactors.
Felder, Stahel

CHE 521 Mass Transfer Operations. *Preq.: CHE 327 or equivalent. 3(3-0) S.* The theory and practice of staged multicomponent mass transfer operations and continuous rate processes. Problems unique to specific operations such as extractive and azeotropic distillation.
Rousseau

CHE 523 Fluid Dynamics and Heat Transfer. *Preq.: CHE 311. 3(3-0) S.* Convective heat transfer in chemical process equipment, such as heat exchangers, chemical reactors, distillation and extraction reboilers, etc., and fluid dynamics and heat transfer in multiphase, multicomponent and chemically reactive systems.
Carbonell, Ferrell

CHE 525 Chemical Process Control. *Preq.: CHE 425. 3(3-0) S.* The application of control techniques to sampled data chemical process systems. Z-transform and state variable methods for the determination of open loop and closed loop system responses and for the synthesis of controller algorithms. Hybrid computer simulation and control of on-line real time processes.
Ferrell, Winston

CHE (OR) 527 Optimization of Engineering Processes. *Preqs.: CHE 451 or OR 501, FORTRAN programming. 3(3-0) F.* The formulation and solution of process optimization problems, with emphasis on nonlinear programming techniques. Computer implementation of optimization algorithms, on-line optimization, simulation methods and structuring of process models to increase computational efficiency.
Felder

CHE 535 Engineering Economy in Air Pollution Control Systems. *Preqs.: MAE 409, CE 576 or equivalent first course. 3(3-2) F.* Design of equipment for the abatement of air pollution; estimation of capital cost and operating expenses; economic optimization under various kinds of tax laws.
Marsland

CHE 543 Technology of Polymers. *Preq.: CHE 223. 3(3-0) S.* Concepts and techniques of macromolecule characterization. Structure, properties, fabrication technology and applications of commercially important polymers.
Koros, Stannett

CHE 561 Biomedical Engineering I: Fluid Flow and Heat Transfer. *Preq.: CHE (BAE) 465 or equivalent background. 3(3-0) S.* The physiology requisite to modeling and analysis of mammalian systems, coupled with the engineering approach to the biomedical problems of flow of fluids (blood, lymph, air, etc.) in the body and thermal transport from the body surfaces.
Beatty, Richardson

CHE (TC) 569 Polymers, Surfactants and Colloidal Materials. *Preqs.: CHE 316, CH 223. 3(3-0) F.* Relationships between molecular structure and bulk properties of nonmetallic materials applied to commercial products and chemical engineering processes. Applications of surface and colloid chemistry and polymer science to product development and process improvement. Hopfenberg

CHE (TC) 570 Radiation Chemistry and Technology of Polymeric Systems. *Preqs.: CH 221, 431. 3(3-0) S.* Principles and practice of isotope and electron beam radiation treatment. Applications of high energy radiation in polymer chemistry and technology, including the use of radiation to cross-link and degrade polymers. Similarities and differences between radiation polymerization and photopolymerization. Stannett, Williams

CHE 597 Chemical Engineering Projects. *Preq.: Grad. standing. 1-3 F,S.* Independent study of some phase of chemical engineering or a related field. Graduate Staff

CHE 598 Special Topics in Chemical Engineering. *Preq.: Grad. standing. 1-3 F,S.* Directed reading of the chemical engineering literature, introduction to research methodology, and lectures and seminar discussion on topics which vary from term to term. Graduate Staff

FOR GRADUATES ONLY

CHE 611 Chemical Process Design and Simulation. *Preq.: CHE 511. 3(3-0) S.* Application of process analysis, simulation and optimization techniques to case studies of complex chemical processes. Felder, Marsland

CHE 613 Thermodynamics II. *Preq.: CHE 513. 3(3-0) S.* Topics in chemical engineering thermodynamics and selected for study in accord with the interests of the class. Irreversible thermodynamics, thermodynamics of polymers and membrane transport, and improvement of thermodynamic efficiencies of unit operations are represented topics. Kilpatrick

CHE 617 Chemical Reaction Engineering. *Preq.: CHE 517. 3(3-0) S.* Design, analysis and scale-up of chemical reactors. Flow models for homogeneous and heterogeneous reactors, reactor stability analysis and computer solution of reactor design equations. Felder, Stahel

CHE 621 Advanced Mass Transfer. *Preqs.: CHE 515, 521. 3(3-0) Alt. F.* Application of transport theory and empirical relations to the analysis, synthesis and design of mass-transfer equipment. Principles and design of absorption, extraction, distillation, humidification and drying operations. Rousseau

CHE 623 Advanced Fluid Dynamics. *Preqs.: CHE 515, 523. 3(3-0) S.* The principles of fluid dynamics and their application to laminar and turbulent flow, flow in closed channels, flow in packed beds and porous media, particle technology, industrial rheology and two-phase flow. Carbonell

CHE 624 Advanced Heat Transfer. *Preq.: CHE 515, 523. 3(3-0) Alt. S.* Heat transfer between liquids and solids, optimum operating conditions and design of equipment, conduction, heating and cooling of solids, and radiant heat transmission. Ferrell

CHE (TC) 669 Diffusion in Polymers. *Preq.: CHE 569 or CI. 2(2-0) S.* The theory of small molecule transport in polymers; applications of membrane transport processes in the chemical, polymer, textile, coatings and natural fiber industries. Hopfenberg

CHE (TC) 671 Special Topics in Polymer Science. *Preq.: CI. 1-3 F.* An intensive treatment of topics in fiber and polymer science and technology selected in accord with the interests of the class. Stannett

CHE 693 Advanced Topics in Chemical Engineering. 1-3 F,S. Recent developments in chemical engineering theory and practice. The topics will vary from term to term.

Graduate Staff

CHE 695 Seminar. 1(1-0) F,S. Weekly seminars on topics of current interest given by resident faculty members, graduate students and visiting lecturers.

Graduate Staff

CHE 697 Advanced Chemical Engineering Projects. *Preq.: Grad. standing in CHE. 1-3 F,S. Sum.* Independent study of some phase of chemical engineering or a related field.

Graduate Staff

CHE 699 Research. *Credits Arranged. F,S.* Individual research in chemical engineering. A report on this research is required as a graduate thesis.

Graduate Staff

Chemistry

GRADUATE FACULTY

Professor K. W. Hanck, Acting Head

Professors: K. J. Bachmann, H. A. Bent, R. D. Bereman, J. Bordner, L. H. Bowen, C. L. Bumgardner, H. H. Carmichael, M. K. DeArmond, L. D. Freedman, F. W. Getzen, F. C. Hentz Jr.—*Assistant Head, Undergraduate Studies*, Z. Z. Hugus Jr., L. A. Jones, S. G. Levine, G. G. Long, M. L. Miles—*Assistant Head, Business Affairs*, C. G. Moreland—*Assistant Head, Graduate Studies*, A. F. Schreiner, W. P. Tucker, G. H. Wahl Jr.; *Adjunct Professor:* M. E. Wall; *Professors Emeriti:* G. O. Doak, R. H. Loeppert, W. A. Reid, P. P. Sutton, R. C. White; *Associate Professors:* C. B. Boss, T. C. Caves, A. F. Coots, Y. Ebisuzaki, W. L. Switzer, D. W. Wertz, M. Whangbo; *Associate Professor Emeritus:* T. M. Ward; *Assistant Professor:* S. Purrington

The Department of Chemistry offers programs leading to the Master of Science and Doctor of Philosophy degrees. Major fields of specialization are analytical, inorganic, organic, nuclear and physical chemistry. A wide variety of advanced courses and a broad spectrum of research topics provide preparation for almost every type of position open to a chemist with an advanced degree.

A student entering graduate work in chemistry should have a bachelor's degree in chemistry or its equivalent. This includes the equivalent of one-year courses in general, organic, physical and analytical chemistry and a semester of inorganic chemistry. At least one year of college physics and two years of mathematics, including differential equations, are necessary. Students who fail to meet these requirements may in some cases be admitted on a provisional basis.

With a large graduate faculty and favorable graduate student to faculty ratio, the chemistry department emphasizes individual attention, small classes and personal collaboration on research with faculty members. Among the variety of active research projects available for thesis work are organic and inorganic synthesis, synthesis/characterization of semiconductors, structure and properties of organometallic compounds and transition metal complexes, stereochemistry,

crystallography, kinetics, radiochemistry, electrochemistry, micro and trace analysis, atomic and plasma spectroscopy, micro computer and statistical applications, quantum chemistry, and infrared, Raman, Mössbauer, nuclear magnetic resonance, nuclear quadrupole resonance, electron spin resonance, and natural and magnetic circular dichroism spectroscopy.

The department is equipped with standard instruments and apparatus for teaching and research. Many items of specialized equipment are available including recording spectrophotometers covering the range from far infrared to ultraviolet, nuclear magnetic resonance spectrometers, gas chromatographs, mass spectrometer, electron spin resonance spectrometer, nuclear quadrupole resonance spectrometer, Mössbauer spectrometer and X-ray diffractometer. Facilities for interfacing laboratory instruments and computers are available. The department's research activities are housed in a nine-story building and supported by glass, machine and electronic shops.

The department has available for qualified applicants teaching and research assistantships, as well as a number of fellowships.

SELECTED ADVANCED UNDERGRADUATE COURSES

CH 401 Systematic Inorganic Chemistry. *Coreq.: CH 431 or CH 331. 3(3-0) S.*

CH 411 Analytical Chemistry I. *Preq.: CH 434. 4(2-6) F.*

CH 413 Analytical Chemistry II. *Preq.: CH 411. 4(2-6) S.*

CH 428 Qualitative Organic Analysis. *Preq.: CH 223. 3(1-6) F,S.*

CH 431 Physical Chemistry I. *Preqs.: CH 107, MA 202, PY 203 or 208; Coreq.: MA 301. 3(2-1) F,S,Sum.*

CH 433 Physical Chemistry II. *Preqs.: CH 431, MA 301. 3(2-1) F,S.*

CH 434 Physical Chemistry II Laboratory. *Preq.: CH 431; Coreq.: CH 433. 2(0-4) S.*

CH 435 Physical Chemistry III. *Preqs.: CH 431, MA 301. 3(3-0) F.*

CH (TC) 461 Introduction to Fiber-Forming Polymers. *Preq.: CH 223. 3(3-0) F.*

CH 490 Chemical Preparations. *Preq.: Three years of CH. 3(0-9) F,S.*

CH 493 Chemical Literature. *Preq.: Three years of CH. 1(1-0) F.*

CH 499 Senior Research in Chemistry. *Preq.: Three years of CH. Credits Arranged. 1-3 F,S,Sum.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

CH 501 Advanced Inorganic Chemistry I. *Preq.: CH 433 or grad. standing. 3(3-0) F.* This course introduces symmetry, point groups and group theory. The major part of the course is devoted to a systematic description of the chemistry of transition elements (3d, 4d, 5d; lanthanides) and selected representative elements. Pertinent introductory discussions of electronic and magnetic structural information will be included.

CH 502 Inorganic Syntheses and Measurements. *Preq.: CH 401. 2(0-6) F.* Synthetic methods in inorganic chemistry, including high-temperature, electrolytic, inert-atmosphere, vacuum line and solvent-system methods. Separation and characterization techniques for inorganic systems will be widely employed.

CH 503 Advanced Inorganic Chemistry II. *Preq.: CH 501. 3(3-0) S.* This course builds on and is a continuation of CH 501. It will include topics from organometallic, photochemical, reaction mechanism and bio-inorganic areas.

CH 505 Physical Methods in Inorganic Chemistry. *Preqs.: Grad. standing and CH 501 or CI. 3(3-0) S.* The course will describe the use of group, molecular orbital and ligand field theories for spectroscopy and bonding; measurement methodology and the significance of experimental parameters, including electronic, photoluminescence, photoelectron, vibrational spectroscopies, magnetic susceptibility, Mössbauer, esr, nmr, nqr and x-ray structure determinations.

CH 511 Chemical Spectroscopy. *Preq.: CH 433. 3(3-0) F.* Theory, bonding and interpretation of spectra as applied to chemical problems. Major emphasis will be placed upon ultraviolet, visible and infrared spectra. (Offered F 1984 and alt. years.)

CH 515 Chemical Instrumentation. *Preq.: CH 431; Coreq.: CH 411. 3(3-0) S.* Basic electronic components and circuits, the response of laboratory instruments, design and modification of typical electronic control and measurement systems. Emphasis will be placed on the transducers and control elements utilized in chemical research.

CH 517 Physical Methods of Elemental Trace Analysis. *Preq.: CH 315 or 331 or CI. 3(3-0) F.* The principles and applications of currently used methods of trace analysis are presented. Designed for students with little or no experience in trace analysis but with a strong interest in or need for analytical data at the trace level. Topics include pulse polarography, potentiometry, UV-Vis spectrophotometry, atomic absorption, emission spectrometry, fluorescence, neutron activation analysis and spark source mass spectrometry.

CH 518 Trace Analysis Laboratory. *Coreq.: CH 517 or CI. 2(0-6) F.* The trace element content of samples is determined by a variety of instrumental techniques including UV-Vis spectrophotometry, fluorescence, emission spectrometry, atomic absorption, pulse polarography and neutron activation analysis.

CH 521 Advanced Organic Chemistry I. *Preqs.: CH 223, 433 or 435. 3(3-0) F.* Structure stereochemistry and reactions of the various classes of hydrocarbons. The molecular orbital treatment of bonding and reactivity of alkenes, the conformational interpretation of cycloalkene and cycloalkene reactivity and the application of optical isomerism to the study of reaction mechanisms will be emphasized.

CH 523 Advanced Organic Chemistry II. *Preq.: CH 521. 3(3-0) S.* An introduction to acid-base theory and mechanistic organic chemistry as applied to synthetically useful organic reactions.

CH 525 Physical Methods in Organic Chemistry. *Preqs.: CH 223 and 433 or 435. 3(3-0) S.* Application of physical methods to the solution of structural problems in organic chemistry. Emphasis will be on spectral methods including infrared, ultraviolet, nuclear magnetic resonance, mass spectrometry, electron paramagnetic resonance, X-ray and electron diffraction and optical rotatory dispersion.

CH 531 Chemical Thermodynamics. *Preqs.: CH 433, MA 301. 3(3-0) F.* An extension of elementary principles to the treatment of ideal and real gases, ideal solutions, electrolytic

solutions, galvanic cells, surface systems and irreversible processes. An introduction to statistical thermodynamics and the estimation of thermodynamic functions from spectroscopic data.

CH 533 Chemical Kinetics. *Preqs.: CH 433, MA 301. 3(3-0) S.* An intensive survey of the basic principles of chemical kinetics with emphasis on experimental and mathematical techniques, elements of the kinetic theory and theory of the transition state. Applications to gas reactions, reactions in solution and mechanism studies. (Offered S 1985 and alt. years.)

CH 535 Surface Phenomena. *Preqs.: CH 433, MA 301. 3(3-0) S.* An intensive survey of the topics of current interest in surface phenomena. Formulations of basic theories are presented together with illustrations of their current applications. (Offered S 1984 and alt. years.)

CH 537 Quantum Chemistry. *Preqs.: MA 301, CH 435 or PY 407. 3(3-0) S.* The elements of wave mechanics applied to stationary energy states and time dependent phenomena. Applications of quantum theory to chemistry, particularly chemical bonds.

CH 539 Colloid Chemistry. *Preqs.: CH 220, 315 or 331, or CI. 3(2-3) S.* Theories, basic principles and fundamental concepts including preparation and behavior of sols, gels, emulsions, foams and aerosols and topics in areas of adsorption, Donnan equilibrium dialysis and small-particle dynamics. Laboratory includes independent project studies in specialized areas. (Offered S 1985 and alt. years.)

CH 541 Nuclear Chemistry. *Preq.: CH 433 or PY 410. 3(2-3) Alt. S.* The basic aspects of nuclear chemistry including: (i) nuclear reactions and energy levels, (ii) the types and energetics of radioactive decay, (iii) the formation and properties of radioactive elements, (iv) the effect of individual isotopes on chemical and physical properties and (v) the effects of nuclear radiation on matter. (Offered S 1984 and alt. years.)

CH (TC) 562 Physical Chemistry of High Polymers—Bulk Properties. *3(3-0) F.* (See textile chemistry.)

CH 595 Special Topics in Chemistry. *Preq.: CI. 1-3 F,S.* Detailed study of a particular problem or technique pertaining to chemistry.

FOR GRADUATES ONLY

CH 613 Electrochemistry. *Preq.: CH 433. 3(3-0) S.* The thermodynamics and kinetics of electrode reactions are presented as well as the experimental methods for studying them. Particular emphasis is placed on the measurement of standard potential and establishing the number of electrons transferred. Applications of electrochemistry in the production/storage of energy and in chemical analysis are discussed. (Offered S 1984 and alt. years.)

CH 625 Organic Reaction Mechanisms. *Preqs.: CH 523, CH 433. 3(3-0) S.* A study of the effects of structure and substituents on the direction and rates of organic reactions.

CH 627 Chemistry of Metal-Organic Compounds. *Preq.: CH 521. 3(3-0) F.* Preparation, properties and reactions of compounds containing the carbon-metal bond with a brief description of their uses.

CH 631 Chemical Thermodynamics II. *Preq.: CH 531. 3(3-0) S.* Statistical interpretation of thermodynamics; use of partition functions; introduction to quantum statistics; application of statistical mechanics to chemical problems, including calculation of thermodynamic properties, equilibria and rate processes. (Offered S 1984 and alt. years.)

CH (BCH) 659 Natural Products. *Preqs.: CH 523, 525 or CI. 3(3-0)* *F.* Illustrative studies of structure determination, synthesis and biosynthesis of natural substances. Modern physical methods and fundamental chemical concepts are stressed. Examples are chosen from such classes as alkaloids, terpenes, steroids and antibiotics.

CH 691 Seminar. *Preq.: Grad. standing in CH. 1(1-0)* *F,S.* Scientific articles, progress reports on research and special problems of interest to chemists are reviewed and discussed.

CH 695 Advanced Topics in Chemistry. *Preq.: CI. Maximum 3* *F,S.* Critical study in one of the branches of chemistry.

CH 699 Chemical Research. *Preq.: Grad. standing in CH. Credits Arranged. F,S.* Special problems that will furnish material for a thesis. A maximum of six semester credits is allowed toward a master's degree; there is no limitation on credits in the doctoral program.

Civil Engineering

GRADUATE FACULTY

Professor P. Z. Zia, Head

Professors: M. Amein, P. D. Cribbins, R. A. Douglas, J. F. Ely, W. S. Galler, A. K. Gupta, K. S. Havner, C. L. Heimbach, Y. Horie, J. W. Horn, L. J. Langfelder, P. H. McDonald, S. W. Nunnally, C. Smallwood Jr., C. C. Tung, H. E. Wahls—*Graduate Administrator; Adjunct Professor:* R. C. Heath; *Professors Emeriti:* W. F. Babcock, R. E. Fadum, A.-A. I. Kashef, M. E. Uyanik; *Associate Professors:* W. L. Bingham, A. C. Chao, J. S. Fisher, E. D. Gurley, D. W. Johnston, N. P. Khosla, H. R. Malcom Jr.—*Assistant Department Head,* V. C. Matzen, J. M. Plecnik, J. C. Smith; *Assistant Professors:* S. H. Ahmad, R. H. Borden, P. C. Lambe, J. M. Nau, M. F. Overton, M. S. Rahman, W. J. Rasdorf, J. R. Stone

The Department of Civil Engineering offers programs of study leading to the Master of Civil Engineering, Master of Science and Doctor of Philosophy degrees. Students may major in construction engineering, geotechnical engineering, structural engineering and mechanics, transportation engineering, coastal and ocean engineering, or sanitary and water resources engineering.

The Master of Civil Engineering degree is a non-thesis program emphasizing engineering design and practice. The program of study must include a minimum of three credit hours of independent study with a final written report. The Master of Science degree requires a thesis for which no more than six semester hours of credit may be used to satisfy the minimum degree requirements. For both degrees, the major and supporting areas of study may be selected from specialty areas within the Department of Civil Engineering. Both degrees require a final oral examination.

For the doctoral program, there are no definite requirements in credit hours. The coursework usually requires about one year of full-time study beyond the master's degree. The major element of the doctoral program is the dissertation, which

reports an original investigation that represents a significant contribution to knowledge.

The faculty is engaged in broad research areas including deterministic and probabilistic structural theories and mechanics, fundamental behavior of soils and structures, highway safety, land use and urban planning, hydraulics and hydrology, coastal processes materials, construction engineering and management, waste disposal and pollution control. Many of the investigations are sponsored by industries and federal and state agencies including the continuing cooperative highway research program. Graduate students are assigned office and laboratory spaces for study and research.

The department cooperates with other University divisions in joint programs. Qualified students may schedule courses in this department and in the Department of City and Regional Planning at the University of North Carolina at Chapel Hill to receive a dual degree, a Master of Science with a major in transportation engineering and a Master of Regional Planning. Multidisciplinary study and research programs are also available through the North Carolina Institute for Transportation Research and Education, Water Resources Research Institute and the North Carolina Sea Grant Program.

Students in other disciplines may develop minor areas of study within the framework of departmental course offerings. In particular, courses of instruction in stream sanitation and industrial waste disposal provide the types of training in pollution often in demand by industry.

A brochure and supplementary information on graduate study, research and assistantships and fellowships are available upon request from the graduate administrator of the Department of Civil Engineering. For applicants without a degree from a U.S. institution, GRE scores are required to expedite consideration for admission and financial aid. This requirement may be waived upon written request for applicants with an exceptional scholastic record.

SELECTED ADVANCED UNDERGRADUATE COURSES

CE 406 Transportation Engineering II. *Req.: CE 305. 3(3-0) F.*

CE 425 Intermediate Structural Analysis. *Req.: CE 325. 3(3-0) S.*

CE 427 Structural Engineering II. *Req.: CE 326. 3(2-2) F.*

CE 428 Structural Design in Wood. *Req.: CE 326. 3(2-2) S.*

CE 443 Soil Engineering II. *Req.: CE 342. 3(3-0) F.*

CE 463 Cost Analysis and Control. *Req.: CE 365. 3(2-3) F.*

CE 464 Legal Aspects of Contracting. *Req.: Sr. standing. 3(3-0) S.*

CE 466 Construction Engineering II. *Reqs.: CE 326, 365. 3(2-3) F.*

CE 484 Water Resources Engineering II. *Req.: CE 383. 3(3-0) F.*

CE 486 Sanitary Engineering Measurements of Water Quality. *Preqs.: Freshman chemistry and sr. standing in Engineering or Agriculture and Life Sciences. 3(2-3) S.*

CE 498 Special Problems in Civil Engineering. *Preq.: Sr. standing. 1-4 F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

CE 501 Transportation Systems Analysis. *Preq.: CE 406. 3(3-0) F.* Application of systems analysis to multi-modal transportation studies. Covers the analysis, planning and design of transport facilities for both the public and private sectors. Planning is discussed from the short-run as well as the long-run perspective. Heimbach

CE 502 Transportation Operations. *Preq.: CE 406. 3(3-0) S.* The analysis of traffic and transportation engineering operations. Graduate Staff

CE 503 Transportation Design. *Preq.: CE 406. 3(2-3) S.* The geometric elements of traffic and transportation engineering design. Cribbins, Horn

CE 504 Water Transportation. *Preq.: CE 305. 3(3-0) F.* The planning, design, construction and operation of waterways, ports, harbors and related facilities. Development of analytical techniques for evaluating the feasibility of piers, ports and multipurpose river basin projects. The design of marine structures and civil works that are significant in civil engineering, including locks, dams, harbors, ports and contractive and protective works. Cribbins

CE 505 Mass Transportation. *Preq.: CE 406. 3(3-0) S.* Definition of the characteristics, trends, issues and technologies related to mass transportation, and the identification of methodologies applicable to the planning, design and management of mass transportation systems. This includes applications to the urban, inter-urban and rural settings for both short- and long-range planning horizons. Stone

CE 506 Municipal Engineering Projects. *Preq.: Sr. standing in CE or CEC. 3(2-3) S.* Special problems relating to public works, public utilities, urban planning and city engineering. Smallwood

CE 507 Airphoto Analysis I. *Preq.: Sr. standing. 3(2-3) F,S.* Principles and concepts for engineering evaluation of aerial photographs, including analysis of soils and surface drainage characteristics. Wahls

CE 511, 512 Continuum Mechanics I, II. *Preqs.: CE 313 or MAE 314, CE 382 or MAE 308, MAE 301, MA 405. (511) 3(3-0) F; (512) 3(3-0) Alt. S.* The concepts of stress and strain are presented in generalized tensor form. Emphasis is placed on the discussion and relative comparisons of the analytical models for elastic, plastic, fluid, viscoelastic, granular and porous media. The underlying thermodynamic principles are presented, the associated boundary value problems are formulated and selected examples are used to illustrate the theory. McDonald

CE 513 Theory of Elasticity I. *Preq.: CE 313 or MAE 314. 3(3-0) F.* The fundamental equations governing the behavior of an elastic solid are developed in various curvilinear coordinate systems. Plane problems, as well as the St. Venant problem of bending, torsion and extension of bars are covered. Displacement fields, stress fields, Airy and complex stress functions are among the methods used to obtain solutions. Douglas, Gurley, Horie

CE 514 Stress Waves. *Preqs.: MA 301; CE 313 or PY 411 or MA 401 or MEA 351. 3(3-0) Alt. F.* Introduction to the theory of stress waves in solids. Origins and nature of longitudinal transverse and surface waves originating at an impact site or from other transient disturbances. Determination of stresses, particle velocities, wave velocities. Introduction to wave

interaction with other waves and with boundaries and dissimilar materials. Introduction to modern instrumentation and seismic refraction exploration. Douglas

CE 521 Advanced Strength of Materials. *Preq.: CE 313 or MAE 314. 3(3-0) F.* Stresses and strains at a point: rosette analysis; strength theories, stress concentration and fatigue; torsion and unsymmetrical bending of open and closed sections; inelastic, composite and curved beams; energy methods; shear deflections; and membrane stresses in shells.

Graduate Staff

CE 522 Elastic Stability. *Preqs.: CE 521, MA 301, 405. 3(3-0) S.* A study of elastic and plastic stability. The stability criterion as a determinant. The energy method and the theorem of stationary potential energy. The solution of buckling problems by finite differences and the calculus of variations. The application of successive approximations to stability problems. Graduate Staff

CE 524 Analysis and Design of Masonry Structures. *Coreq.: CE 427. 3(3-0) F.* Theory and design of masonry arches, culverts, dams, foundations and masonry walls subjected to lateral loads. Plecnik

CE 525 Matrix Structural Analysis. *Preq.: CE 425. 3(3-0) F.* Direct formulation of the banded system stiffness matrix and loading vectors for a first order Displacement Method analysis of two- and three-dimensional structural frames, trusses and grids; analysis by sub-structures; effects of prestrain, temperature, support settlements, shear deformations and joint deformations; second order analysis; computer applications using existing computer programs. Smith

CE 526 Finite Element Methods for Civil Engineering. *Preqs.: CE 425 and prior programming knowledge. 3(3-0) S.* A basic course in finite element method for civil engineering. Development, theory and formulation of various finite elements. On-hand finite element computer programming. On-hand finite element analysis of civil engineering problems, such as dam structures, hyperbolic cooling towers, slabs and soil-structure interaction problems. Gupta

CE 527 Analysis and Design of Structures for Dynamic Loads. *Preq. or coreq.: CE 525. 3(3-0) F.* Analysis and design of single and multi-degree-of-freedom structures subjected to various types of excitations and initial conditions. Computational aspects of dynamic analysis. Introduction to nonlinear analysis techniques and to approximate methods of analysis. Consideration of strong motion earthquakes. Study of earthquake regulations in building codes. Matzen

CE 531 Structural Models. *Preq.: CE 427. 3(2-3) F.* Dimensional analysis and structural similitude, indirect and direct models, model materials and experimental techniques, individual project in structural model analysis. Matzen, Zia

CE 534 Plastic Analysis and Design. *Preq.: CE 427. 3(3-0) S.* Theory of plastic behavior of steel structures; concept of design for ultimate load and the use of load factors. Analysis and design of components of steel frames including bracings and connections. Ely, Smith

CE 536 Theory and Design of Prestressed Concrete. *Coreq.: CE 427. 3(3-0) F.* The principles and concepts of design in prestressed concrete including elastic and ultimate strength analyses for flexure, shear, torsion, bond and deflection. Principles of concordancy and linear transformation for indeterminate prestressed structures. Application of prestressing to tanks and shells. Ahmad, Zia

CE (MEA) 541 Gravity Wave Theory I. *3(3-0) S.* (See marine, earth and atmospheric sciences.)

CE 543 Hydraulics of Ground Water. *Preq.: CE 382 or 342 or equivalent. 3(3-0) S.* Principles of ground water hydraulics; theory of flow through idealized porous media; the flow net solution; seepage and well problems. Lambe, Rahman

CE 544 Foundation Engineering. *Preq.: CE 342. 3(3-0) S.* Subsoil investigations; excavations; design of sheeting and bracing systems; control of water; footing, grillage and pile foundations; caisson and cofferdam methods of construction. Borden

CE 548 Engineering Properties of Soils I. *Preq.: CE 342. 3(2-3) F.* The study of soil properties that are significant in earthwork engineering, including properties of soil solids, basic physiochemical concepts, classification, identification, plasticity; permeability, capillarity and stabilization. Laboratory work includes classification, permeability and compaction tests. Borden

CE 549 Engineering Properties of Soils II. *Preq.: CE 548. 3(2-3) S.* Continuation of CE 548, including the study of compressibility, stress-strain relations and shear strength theories for soil. Laboratory work includes consolidation and shear strength tests. Borden

CE 551 Theory of Concrete Mixtures. *Preq.: CE 332. 3(3-0) F.* A study in depth of the theory of portland cement concrete mixtures including types and properties of portland special cements; chemical reactions; brief examination of history of mixture design; detailed study of current design methods; properties of fresh and hardened concretes; strength-age-curing relationships; durability; admixtures; special concretes; production and quality control. Graduate Staff

CE 553 Asphalt and Bituminous Materials. *Preq.: CE 332. 3(2-3) F.* A study in depth of properties of asphalts and tars for use in waterproofing and bituminous materials, and theories of design of bituminous mixtures for construction and paving uses including types and properties of asphalt cements, cutbacks, emulsions, blown asphalts and tars; brief examination of historical developments; detailed study of properties and design of bituminous mixtures; and current research. Laboratory work includes standard tests on asphalts, tars and road oils; design, manufacture and testing of trial batches; and current research techniques. Khosla

CE 555 Highway and Airport Pavement Design. *Preq.: CE 406 or 443. 3(2-3) S.* Theoretical analysis and design of highway and airport pavements with critical evaluation of current design practices. Khosla

CE 561 Construction Planning and Scheduling. *Preq.: CE 463. 3(3-0) F.* Construction project planning, scheduling and control utilizing network methods. Both manual and computer techniques will be applied. Introduction to other quantitative management methods in construction. Utilizing the principles developed, students will bid, plan, schedule and manage a construction project under competitive conditions in a computer-simulated environment. Nunnally

CE 562 Construction Productivity. *Preq.: CE 463 or equivalent. 3(3-0) F.* Methods of collecting, assembling and analyzing construction productivity data in order to increase construction productivity. Applications of methods improvement techniques such as time-lapse photography, flow charts, process charts and time standards to the improvement of construction productivity. Safety and human factors in construction and their relation to construction productivity. Nunnally

CE 566 Building Construction Systems. *Preq.: CE 466 or CE 427 or grad. standing in ARC. 3(3-0) S.* Construction engineering of conventional and industrialized building systems. Emphasis in the areas of structural systems utilizing cast-in-place concrete, precast concrete, prestressed concrete, structural steel, cold-formed steel, masonry, timber, composite

and mixed materials. Topics include mechanisms for resisting and transmitting loads, detailing, fabrication, transportation, erection, stability, shoring, quality control and integration of service systems. Johnston

CE (BAE, MB) 570 Sanitary Microbiology. *Preq.: MB 401 or equivalent. 3(2-3) S.* Fundamental aspects of microbiology and biochemistry are presented and related to problems of stream pollution, refuse disposal and biological treatment. Laboratory exercises present basic microbiological techniques and illustrate from a chemical viewpoint some of the basic microbial aspects of waste disposal. Chao

CE 571 Theory of Water and Waste Treatment. *Preq.: Grad. standing. 3(3-0) F.* Study of the basic physical and chemical processes underlying water and waste treatment, including mass transfer, equilibria, and kinetics. Galler

CE 572 Design of Water and Wastewater Facilities. *Preq.: CE 571. 3(3-0) S.* Theory and design of water and wastewater treatment plants. Smallwood

CE 573 Unit Operations and Processes in Waste Treatment. *Preq.: CE 486; Coreq.: CE 571. 3(1-6) F.* Unit operations and processes in water and wastes engineering, including sedimentation, thickening, chemical coagulation, vacuum filtration, carbon adsorption, biological treatment, and special projects. Chao, Galler

CE (NE) 574 Environmental Consequences of Nuclear Power. *Preq.: CI. 3(3-0) S.* An examination of the environmental consequences resulting from the siting, construction and operation of nuclear power plants as well as the environmental consequences of alternatives to nuclear power. Fuel sources; fuel reprocessing; sources and treatment of solid, liquid, gaseous wastes; the costs of minimizing wastes and the effects of rejected heat; beneficial uses of rejected heat; pertinent federal and state regulations are examined. Smallwood

CE 575 Civil Engineering Systems. *Preq.: MA 405. 3(3-0) S.* An examination of civil engineering systems and their design optimization. The systems to be studied include water resources engineering, structural engineering, transportation engineering and construction. Galler

CE 576 Atmospheric Pollution. *Preq.: Grad. or advanced undergrad. standing. 3(3-0) S.* A survey of the problem of atmospheric pollution. Topics to be discussed include: pollutant sources; effects on man and other animals, vegetation, materials and visibility; meteorological factors, air sampling; control devices; air quality and emission standards; and legal, economic and administrative aspects. Graduate Staff

CE (BAE) 578 Agricultural Waste Management. *3(2-3) F.* (See biological and agricultural engineering.)

CE 580 Flow in Open Channels. *Preq.: CE 382. 3(3-0) F,S.* The theory and applications of flow in open channels, including dimensional analysis, momentum-energy principle, gradually varied flow, high-velocity flow, energy dissipators, spillways, waves, channel transitions and model studies. Amein

CE 581 Behavior and Analysis of Ocean Structures. *Preqs.: CE 382 and CE 325 or equivalent. 3(3-0) S.* Statistical properties of the sea surface and wave field, analysis of wave forces on small bodies, analysis of wave forces on large bodies, offshore structures, soil structure interactions, risk analysis of marine structures, mooring dynamics. Tung

CE 582 Coastal Hydrodynamics. *Preq.: CE 382 or equivalent. 3(3-0) F.* Surface gravity waves, solitary waves, longwaves, impulsively generated waves, flow in inlets and estuaries, storm surge, wave refraction and diffraction, harbor oscillations. Overton

CE 583 Engineering Aspects of Coastal Processes. *Preq.: CE 382 or equivalent; Coreq.: MEA (CE) 541. 3(3-0) S.* Coastal environment, engineering aspects of the mechanics of sediment movement, littoral drift, beach profiles, beach stability, meteorological effects, tidal inlets, inlet stability, shoaling, deltas, beach nourishment, mixing processes, pollution of coastal waters, interaction between shore processes and man-made structures, case studies.

Fisher

CE 585 Urban Stormwater Management. *Preq.: CE 383. 3(3-0) F.* Studies of stormwater management in urban areas emphasizing quantitative problems in flooding, sedimentation and water quality. Review and extension of design concepts involving channels and impoundments. Survey of hydrographic formation techniques and examination of common hydrologic models. Case studies of urbanizing watersheds.

Malcom

CE 589 Special Topics in Civil Engineering. *3(3-0) F,S.* New or special course on recent developments in some phase of civil engineering. Specific topics and prerequisites are identified for each section and will vary from term to term.

Graduate Staff

CE 591, 592 Civil Engineering Seminar. *1(1-0) F,S.* Discussions and reports of subjects in civil engineering and allied fields.

Graduate Staff

CE 598 Civil Engineering Projects. *1-6 F,S.* Research- or design-oriented independent study and investigation of a specific civil engineering topic, which culminates in a final written report. A minimum of three credits required for the MCE degree.

Graduate Staff

FOR GRADUATES ONLY

CE 601 Transportation Planning. *Preq.: CE 502. 3(3-0) S.* The planning, administration, economics and financing of various transportation engineering facilities.

Cribbins

CE 602 Advanced Transportation Design. *Preq.: CE 503. 3(2-3) F.* Design of major traffic and transportation engineering projects.

Horn

CE 603 Airport Planning and Design. *Coreq.: CE 502. 3(2-3) F.* The analysis, planning and design of air transportation facilities.

Cribbins

CE 604 Urban Transportation Planning. *Preq.: CE 502. 3(3-0) S.* Planning and design of urban transportation systems as related to comprehensive urban planning; principles of land use planning, urban thoroughfare planning and regional planning.

Heimbach

CE 605 Traffic Flow Theory. *Preqs.: CE 502, ST 515. 3(3-0) F.* The theoretical techniques used to describe vehicular traffic movement on a street or highway network, including the use of differential-difference equations, hydrodynamic models, probabilistic models, and computer simulation.

Heimbach

CE 614 Plasticity and Limit Analysis. *Preq.: CE 513 or 521. 3(3-0) Alt. S.* Stress-strain rate relationships and theorems of limit analysis and shakedown in plastic solids. Application to collapse load calculations in arches, rings, plates and axisymmetric shells. Introduction to slip-line field theory of plane plastic flow and to dynamic limit analysis.

Havner

CE 615 Inelastic Solids. *Preqs.: CE 511 and MA 511. 3(3-0) F.* Application of classical continuum mechanics to the study of nonlinear and inelastic behavior of solid materials, with emphasis on metal plasticity. Constitutive equations for thermo-mechanical behavior of crystals and polycrystalline solids at finite strain; analytical connections between microscopic and macroscopic behavior. General theorems governing incremental boundary-value problems, bifurcation and stability. Considerations of experiment.

Havner

CE 618 Optical Mechanics. *Preq.: CE 311. 3(2-3) Alt. S.* Concepts of crystal optics applied to continua deformed statically or dynamically by mechanical loading; optical interference and its use as a measuring technique of absolute and relative retardations in various types of interferometers; relative retardation measurements; deformation measurements with diffraction grating; Moire (mechanical) interference measurements. Bingham

CE 619 Experimental Methods in Mechanics. *Preq.: CI. 3(2-3) Alt. S.* A study of specialized experimental techniques utilized in contemporary research in the areas of mechanics. Bingham, Douglas

CE 620 Numerical Methods in Structural Mechanics. *Preqs.: CE 525 and CE 521 or CE 513. 3(3-0) F.* Finite difference and finite element methods in two- and three-dimensional elastic structures, including plates, plane stress and plane strain problems, axisymmetric solids. Analytical basis of approximations: series expansions; energy theorems; virtual work. Matrix decompositions and iteration techniques for digital computer solution. Introduction to nonlinear analysis. Havner

CE 623 Theory of Plates and Shells. *Preq.: CE 513 or CE 521. 3(3-0) F.* Small and large deflection theories of thin plates; membrane analysis of shells. Various methods of analysis are discussed and illustrated by problems of practical interest. Gupta

CE 624 Analysis and Design of Structural Shells and Folded Plates. *Preq.: CE 623. 3(3-0) Alt. S.* Treatment of roof structures in the form of folded and curved surfaces. Membrane and bending stress analysis of folded plates, shells of revolution, cylindrical and conical shells and free-form systems. Numerical and closed form solutions. Design criteria for concrete and metallic structures. Gupta

CE 625, 626 Advanced Structural Design I, II. *Preqs.: (625): CE 427, CE 525; (626) CE 427; Coreqs.: (626) CE 525, 526. (625) 3(3-0) F. (626) 3(2-3) Alt. S.* Complete structural design of a variety of projects including comparative study of alternative solutions. Discussions of long span structural systems. Graduate Staff

CE 627 Advanced Analysis and Design of Structures for Dynamic Loads. *Preq.: CE 527. 3(3-0) Alt. S.* Consideration of the following advanced topics in the analysis and design of structures for dynamic loads: eigenvalue routines and numerical integration techniques; response analysis through the frequency domain; investigation of damping; variational formulation of the equations of motion; analysis and design of continuous systems; approximate methods of analysis; and special topics. Matzen

CE 628 Earthquake Structural Engineering. *Preq.: CE 527. 3(3-0) S.* Study of the effects of earthquakes on structures and of the design of structures to resist earthquake motions; earthquake mechanisms and ground motions; response of structures to earthquake motions; behavior of materials, structural elements and assemblages subjected to earthquakes; principles of earthquake-resistant design practice; soil-structure interactions; and special topics. Gupta, Nau

CE 632 Probabilistic Methods of Structural Engineering. *Preqs.: CE 525 and MA 421. 3(3-0) Alt. S.* Application of probability theory and stochastic processes to the study of safety of structures. Fundamentals of probability theory and stochastic processes; probabilistic modelings of structural loadings, material properties and risk. Reliability analysis of structures; reliability-based design criteria. Random vibration of simple structures; safety analysis of structures under dynamic loads. Tung

CE 635 Advanced Theory of Concrete Structures. *Preq.: CE 536. 3(3-0) S.* Inelastic theory of structural concrete members under flexure, axial load, combined flexure and axial compression, shear and torsion. Yield line theory of slabs. Limit analysis of beams and frames of reinforced and prestressed concrete. Zia

CE 641, 642 Advanced Soil Mechanics. *Preq.: Grad. standing. 3(3-0) F,S.* Theories of soil mechanics; failure conditions; mechanical interaction between solids and water, and problems in elasticity and plasticity pertaining to earthwork engineering. Wahls

CE 644 Ground Water Engineering. *Preq.: CE 543 or equivalent. 3(3-0) F.* Ground water problems as related to engineering works, ground water circulation and inventories, subsidence of the ground and its evaluation due to pumping, method of images applied to water circulation of wastes and salt water encroachment in coastal aquifers, transient flow systems in wells and earth dams and embankments. Leakage problems, practical ground water problems and their analysis by computers and electrical models. The legal aspects of ground water conservation and the implied technical and engineering phases.

Graduate Staff

CE 646 Dynamics of Soils and Foundations. *Preq.: CE 641. 3(3-0) S.* The application of vibration and wave propagation theories to soil media; the review of existing experimental data and empirical procedures for analysis of foundation vibrations, the prediction of soil responses to impulse loads, dynamic properties of soils and methods for their determination, design procedures for foundation subjected to dynamic forces. Borden, Rahman, Wahls

CE 665 Construction Equipment Systems. *Preq.: CE 561 or CE 562 or equivalent. 3(3-0) S.* Analysis of earthmoving and other heavy construction processes as systems in order to optimize the selection and employment of construction equipment. Considerations in system design, cost and productivity estimation, operational procedures, safety, and maintenance. Computer applications utilizing analytical and simulation techniques. Nunnally

CE 671 Advanced Water Management Systems. *Preq.: CE 484; Coreqs.: CE 571, 573. 4(3-3) F.* The application of systems analysis methods to the design, analysis and management of water and waste systems. Galler

CE 672 Advanced Water and Waste Treatment: Principles and Design. *Preq.: CE 571. 4(3-3) S.* Theory and design of physiochemical processes used to control phosphorus, nitrogen, trace metals and toxic organic substances in water. Galler

CE 673 Industrial Water Supply and Waste Disposal. *Coreq.: CE 571. 3(3-0) F,S.* Water requirements of industry and the disposal of industries wastes. Smallwood

CE 674 Stream Sanitation. *Coreq.: CE 571. 3(3-0) F,S.* Biological, chemical and hydrological factors that affect stream sanitation and stream use. Smallwood

CE 685 Design of Coastal Facilities. *Preqs.: CE 582 and CE 583. 3(3-0) F.* Types and functions of coastal structures, computation of wave forces on coastal structures, wave uprush, shore protection against waves and storms, planning and design of navigation channels, port development, harbor design, dredging technology, planning and design of offshore platforms, technology of disposal of wastes and heated discharge, consideration of environmental effects of waste disposal. Fisher

CE 687 Numerical Modeling for Nearshore Flow Systems. *Preq.: CE 580 or CE 582 or MEA (CE) 541 or equivalent. 3(3-0) S.* Basic concepts of finite difference methods, methods of characteristics, estuarine and inlet flow computations, implicit methods, surge on the open coast. Introduction to circulation in sounds and bays, modeling of ocean circulation, modeling of sediment movement, mixing processes, water quality modeling. Amein

CE 689 Advanced Topics in Civil Engineering. *3(3-0) F,S.* New or special course on advanced developments in some phase of civil engineering. Specific topics and prerequisites are identified for each section and will vary from term to term. Graduate Staff

CE 698 Advanced Reading in Civil Engineering. *Preq.: Grad. standing. 1-3 F,S.* Directed reading of advanced topics in some phase of civil engineering. Graduate Staff

CE 699 Civil Engineering Research. *Credits Arranged. F,S.* Independent investigation of an advanced civil engineering problem; a report of such an investigation is required as a graduate thesis. Graduate Staff

Computer Science

GRADUATE FACULTY

Professor D. C. Martin, Head

Professors: W. Chou, L. B. Martin, D. F. McAllister, R. J. Plemmons, A. L. Tharp; *Professor Emeritus:* P. E. Lewis; *Associate Professors:* E. W. Davis Jr., R. J. Fornaro, T. L. Honeycutt, H. G. Perros, W. E. Robbins, R. D. Rodman, W. J. Stewart, K.-C. Tai; *Assistant Professors:* M. J. Lee, C. D. Savage, N. F. Williamson Jr.; *Assistant Professor Emeritus:* J. W. Hanson

The Department of Computer Science offers a minor program for graduate students majoring in other fields. A student wishing to minor in computer science should have knowledge of a programming language and should anticipate a research project involving computers. For a candidate for a master's degree, three courses at the 400 level or above are required, and the student is encouraged to take at least one course at the 500 level or above. For a Ph.D. candidate, no specific courses are required, but the student is expected to achieve a high level of proficiency in at least one of these five areas of computer science: foundations, computer systems, numerical processing, programming languages (including compiler design) and information systems. The student's advisory committee, in conjunction with the computer science graduate administrator, will assist in selecting a meaningful sequence of courses.

Computer science is an active and leading participant in the Computer Studies Program. This master's-level program allows a major emphasis in computer science with non-thesis or thesis options. The program's core requirements emphasize a cooperative effort between computer science and engineering and reflect a narrowing gap between software and hardware.

Computer science also has established with the Department of Electrical and Computer Engineering a cooperative program. This program leads to a degree in electrical and computer engineering with emphasis in computer science. The requirement for this degree is satisfied in such a way that a strong emphasis is placed on computer science in both course and research work.

Students admitted to this program are expected to satisfy all requirements for admission to the Graduate School. In addition, they should have a strong background in mathematics, statistics or the physical sciences, and a working knowledge of a versatile, higher-level programming language, such as PASCAL or

PL/1. Students lacking necessary background will be required to take courses which eliminate the deficiencies in addition to their normal program of study. A few research and teaching assistantships are available each year to qualified program applicants.

For additional information regarding computer science programs write: Computer Science Department, P. O. Box 5972, Raleigh, North Carolina 27650.

SELECTED ADVANCED UNDERGRADUATE COURSES

CSC 405 Introduction to Systems Programs. *Preqs.: CSC 202, 256, 311. 3(3-0) F.*

CSC 411 Introduction to Simulation. *Preqs.: Proficiency in a programming language, MA 202, ST 372. 3(3-0) F,S.*

CSC 412 Introduction to Computability, Languages and Automata. *Preq.: CSC 322. 3(3-0) F,S.*

CSC (MA) 416 Introduction to Combinatorics. *Preq.: MA 403 or CSC 322. 3(3-0) Alt. yrs.*

CSC 421 Introduction to Management Information Systems. *Preq.: CSC 311. 3(3-0) F.*

CSC (MA) 427 Introduction to Numerical Analysis I. *Preqs.: MA 301 or MA 312 and programming language proficiency. 3(3-0) F.*

CSC (MA) 428 Introduction to Numerical Analysis II. *Preqs.: MA 405 and programming language proficiency. 3(3-0) F.*

CSC 431 File Organization and Processing. *Preq.: CSC 311. 3(3-0) S.*

CSC 495 Special Topics in Computer Science. *Preq.: CI. 1-6 F,S.*

CSC 499 Undergraduate Research in Computer Science. *Preq.: CI. 1-6 F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

CSC (CSE, ECE) 501 Design of Systems Programs. *3(3-0) F. (See computer studies.)*

CSC 504 Application of Linguistic Techniques to Computer Problems. *Preq.: CSE 502. 3(3-0) S.* Semiotics and programming languages. Comparison of semantic theories. Representation, classification and interpretation of scenes and other multi-dimensional illustrations. Design of a formal language for describing two-dimensional geometric figures, such as flowcharts, chemical structures and logic diagrams. Characterization of programming languages according to the theory of transformational grammar.

CSC (CSE, ECE) 506 Digital Systems Architecture. *3(3-0) F. (See computer studies.)*

CSC (CSE, ECE) 510 Software Engineering. *3(3-0) F. (See computer studies.)*

CSC (CSE, ECE) 512 Compiler Construction. *3(3-0) S. (See computer studies.)*

CSC 532 Artificial Intelligence II. *Preqs.: CSE 511, course in mathematical logic. 3(3-0) S.* A rigorous approach to artificial intelligence emphasizing pattern recognition, theorem proving, game playing, learning and heuristic programming. Students will be assigned computer projects illustrating theoretical concepts introduced in lecture.

CSC (CSE, ECE) 542 Database Management. *3(3-0) F.* (See computer studies.)

CSC (CSE, ECE, IE, OR) 562 Advanced Topics in Computer Simulation. *3(3-0) F.* (See computer studies.)

CSC (CSE, ECE) 571 Data Transmission/Communications. *3(3-0) S.* (See computer studies.)

CSC (CSE, ECE) 572 Computer Communications. *3(3-0) F.* (See computer studies.)

CSC (CSE, ECE) 574 Real Time Computer Systems. *3(3-0) Alt. S.* (See computer studies.)

CSC (MA) 582 Numerical Linear Analysis. *Preqs.: MA 405 or equivalent and a knowledge of computer programming. 3(3-0) F.* A mathematical and numerical investigation of direct iterative and semi-iterative methods for the solution of linear systems. Methods for the calculation of eigenvalues and eigenvectors of matrices.

CSC (MA) 583 Numerical Solution of Ordinary Differential Equations. *Preq.: Knowledge to the level of CSC 427. 3(3-0) S.* Numerical methods for initial value problem including predictor-corrector, Runge-Kutta, hybrid and extrapolation methods; stiff systems; shooting methods for two-point boundary value problems; weak, absolute and relative stability results.

CSC (MA) 584 Numerical Solution of Partial Differential Equations—Finite Difference Methods. *Preq.: Knowledge to the level of CSC 427-428. 3(3-0) F,S.* Numerical methods for the solutions of parabolic, elliptic and hyperbolic partial differential equations including stability and convergence results.

CSC (MA, OR) 585 Graph Theory. *Preq.: MA 405. 3(3-0) F.* Basic concepts of graph theory. Trees and forests. Vector spaces associated with a graph. Representation of graphs by binary matrices and list structures. Traversability. Connectivity. Matching and assignment problems. Planar graphs. Colorability. Directed graphs. Applications of graph theory with emphasis on organizing problems in a form suitable for computer solution.

CSC (MA) 587 Numerical Solution of Partial Differential Equations—Finite Element Method. *3(3-0) S.* (See mathematics.)

CSC 595 Special Topics. *Preq.: CI. 1-6 F,S.* Topics of current interest in computer science not covered in existing courses.

FOR GRADUATES ONLY

CSC 603 Computational Semantics. *Preqs.: CSE 502, course in mathematical logic. 3(3-0) F.* Theoretical prerequisites and computational techniques for the mechanical interpretation of artificial and natural language sentences. Semantics of formal languages. Structural representations of meaning. Semantics of natural languages.

CSC (CSE, ECE) 671 Computer Systems Performance Evaluation. *3(3-0) Alt. S.* (See computer studies.)

Computer Studies

Professor Wushow Chou, Program Director

For a listing of graduate faculty, refer to the computer studies brochure available at the office of the Computer Studies Program.

The computer studies program is an interdisciplinary graduate program which is administratively supported by the Departments of Computer Science and Electrical and Computer Engineering, with participation by faculty members primarily from computer science, electrical and computer engineering and operations research.

The program integrates the computer software oriented curriculum of the Department of Computer Science and the computer hardware oriented curriculum from the Department of Electrical and Computer Engineering into a single curriculum. This is in contrast to the traditional arrangement in which the curriculum in an independent computer science department emphasizes software systems and computing theory while the computer engineering curriculum in an electrical and computer engineering department emphasizes hardware systems. The need for the merging of these two types of curricula has been recognized by several other schools through cross-listed courses and joint degree programs. North Carolina State University takes a more positive step by creating a single administrative unit to incorporate the curricula at the graduate level.

Although courses and thesis topics may be chosen in a variety of fields, this program's unique strength lies with the fields combining computer science and computer engineering. These fields include: computer system architecture and design, computer communications and numerical and optimization techniques.

The field of computer system architecture and design deals with the specification, design and analysis of digital systems, including the study of system architecture, design algorithms and automation, fault tolerant design and simulation. The field of computer communications deals with the methodology of utilizing the state-of-the-art capability of computers and telecommunications for reliable, economic and responsive transfer of digitized information among data transmission equipment, which may be various computers, terminals or telephones with digitized voices. The field of numerical and optimization techniques is concerned with the study of the structure and properties of systems with large numbers of interdependent variables, and with the methodology and application of numerical analysis, dynamical systems theory and systems analysis and mathematical programming of such systems.

For students pursuing a master's degree in computer studies, there are two options: the thesis option, the Master of Science in computer studies and the non-thesis option, the Master of Computer Studies.

Remedial Courses

The immigration modules, CSE 452 through CSE 459, are the remedial courses that are structured primarily for students with a bachelor's degree in one of the

quantitative sciences, but with little computer background. However, proficiency in a high-level programming language is assumed. Each module provides in a condensed format the prerequisite knowledge for most first year graduate courses in the program. Each entering student would select, upon advice of the program faculty, those immigration modules necessary to eliminate deficiencies relevant to the program of study. Credit toward satisfying degree requirements for computer studies majors would not be allowed for the immigration modules.

Core Courses

Three core courses, CSE (CSC, ECE) 501, Design of Systems Programs, CSE 505, Design and Analysis of Algorithms and CSE (CSC, ECE) 506, Digital Systems Architecture, are intended to provide a thorough basic knowledge upon which the elective courses may be built. For the non-thesis option, all three are required. For the thesis option, CSE (CSC, ECE) 506 is required and a student may elect either CSE (CSC, ECE) 501 or CSE 505 as the second core course.

Elective Courses

All other courses listed below are elective courses. For classification of the elective courses according to subject areas and for further details, refer to the computer studies brochure.

SELECTED ADVANCED UNDERGRADUATE COURSES

CSE 452 Assembly Language and Basic Computer Organization. *Preqs.: Higher level programming language and CI. 1(1-0) F.*

CSE 453 Data Structures. *Preqs.: Higher level programming language and CI; Coreq.: CSE 452 or equivalent. 1(1-0) F.*

CSE 454 Computer Organization and Logic. *Preqs.: CSE 452 or equivalent and CI. 1(1-0) S.*

CSE 455 Applied Algebraic Structures. *Preqs.: MA 201, higher level programming language and CI. 1(1-0) F.*

CSE 456 Introduction to Computability. *Preqs.: CSE 455 or equivalent and CI. 1(1-0) S.*

CSE 457 Electric Circuits. *Preqs.: MA 202, PY 208, B average in MA and PY. 1(3-0) F.*

CSE 458 Electronic Circuits. *Preq.: CSE 457. 1(3-0) F.*

CSE 459 Linear Systems. *Preqs.: CSE 458, B average in PY. 1(3-0) F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

CSE (CSC, ECE) 501 Design of Systems Programs. *Preqs.: CSE 452 and CSE 453. 3(3-0) F.* Fundamentals of translators, operating systems and file management systems. Assemblers, macro processors, linkers and loaders. Sequential and concurrent processes, processor and memory management. File structures and file indexing techniques, including hashing, B-trees, AVL trees and tries.

CSE 502 Computational Linguistics. *Preq.: CI 3(3-0) F.* Natural language processing by computer. Finite-state, context-free, context-sensitive and transformational grammars. Parsing mechanisms including augmented transition networks. Analysis of complex English sentences. Question-answering systems.

CSE 505 Design and Analysis of Algorithms. *Preq.: CSC 311 or CSE 453. 3(3-0) S.* Study of techniques for the design of algorithms. Complexity and analysis of algorithms. Study of algorithms for certain classical problems that include sorting, searching, graphs, numerical algorithms and pattern matching.

CSE (CSC, ECE) 506 Digital Systems Architecture. *Preq.: ECE 340 or CSC 312 or CSE 454. 3(3-0) F.* Digital systems architecture is the middle ground on which the interests of software, hardware and firmware come together. Among the topics considered are: architectural descriptions, storage systems, I/O systems, stack machines and parallelism. The structure of digital systems implementation will also be considered as it relates to architecture.

CSE (CSC, ECE) 510 Software Engineering. *Preqs.: CSC 311 and CSC 322 or CSE 453 and CSE 455 or equivalent. 3(3-0) F.* The course will introduce the principles and methods for the design, coding and validation of software systems. Among the topics covered are: software design techniques, programming methodology, program testing, proofs of program correctness, software reliability and software management.

CSE 511 Artificial Intelligence. *Preq.: CSC 311. 3(3-0) F.* Definition of heuristic versus algorithmic methods, rationale of heuristic approach, description of cognitive processes. Objectives of work in artificial intelligence, simulation of cognitive behavior. Heuristic programming techniques. Survey of examples from representative application areas. The mind-brain problem and the nature of intelligence. Individual projects to illustrate basic concepts.

CSE (CSC, ECE) 512 Compiler Construction. *Preq.: CSC 311 or CSE 453. 3(3-0) S.* This course is intended to provide a detailed understanding of the techniques used in the design and implementation of compilers. Introduction to formal grammars and relations concerning a grammar. Detailed study of algorithms for lexical scanners, top-down recognizers, bottom-up recognizers for simple precedence grammars, operator precedence grammars, high order precedence grammars and bounded-context grammars. Runtime storage organization for a compiler including symbol tables, internal forms for source programs, semantic routines, error recovery and diagnostics, code generation and optimization and interpreters.

CSE (ECE) 513 Digital Signal Processing. *3(3-0) F.* (See electrical and computer engineering.)

CSE (ECE) 514 Random Processes. *3(3-0) F.* (See electrical and computer engineering.)

CSE (ECE) 520 Fundamentals of Logic Systems. *3(3-0) F.* (See electrical and computer engineering.)

CSE (ECE) 521 Digital Computer Technology and Design. *3(3-0) S.* (See electrical and computer engineering.)

CSE 522 Formal Languages and Syntactic Analysis. *Preq.: CSC 412 (CSE 512 recommended). 3(3-0) F.* Detailed study of formal languages and their relation to automata: languages and their representation, grammars, finite automata and regular grammars, context-free grammars and pushdown automata, type 0 grammars and Turing machines, the Halting Problem, context-sensitive grammars and linear bounded automata and operations of languages.

CSE (MA) 529, 530 Numerical Analysis I, II. *Preqs.: 3(3-0) F,S.* (See mathematics.)

CSE (ECE) 533 Digital Electronics. *3(3-0) S.* (See electrical and computer engineering.)

CSE (MA) 536 Theory of Sequential Machines. *Preq.: CSC 412 or grad. standing. 3(3-0) F.* Sequential machine identification experiments. Finite-Memory machines. Special classes of machines. Decomposition of sequential machines. Linear sequential machines. Sequential relations of finite-state machines.

CSE (MA) 537 Theory of Computability. *Preq.: CSC 412 or grad. standing. 3(3-0) S.* The concept of effective computability. Turing machines. Primitive recursive functions. The μ -operator. μ -recursive functions. Godel numbering. Equivalence of Turing machines and μ -recursion. Undecidable predicates. Universal Turing machines. Other formulations of the concept of effective computability.

CSE (CSC, ECE) 542 Database Management. *Preq.: CSC 431 or CSE (CSC, ECE) 501. 3(3-0) F.* The course covers the fundamentals of the area of database management. Basic topics include: general architecture for database management systems; current data models such as network, relational, hierarchical; security and integrity; discussion of current implemented systems.

CSE (ECE) 558 Image Processing. *3(3-0) Every yr.* (See electrical and computer engineering.)

CSE (ECE) 559 Pattern Recognition. *3(3-0) S.* (See electrical and computer engineering.)

CSE (CSC, ECE, OR, IE) 562 Advanced Topics in Computer Simulation. *Preq.: ST 421 or equivalent or grad. standing. 3(3-0) F.* Basic simulation methodology; general principles of the Monte Carlo method: random number generation, accuracy, variance reduction methods, classical applications in mathematics and physics; simulation of queueing systems; development of a research problem in depth where computer simulation is required 1) to provide insight through experimentation with a model, 2) to provide approximate answers and practical solutions and 3) to test the model and the solutions.

CSE (CSC, ECE) 571 Data Transmission/Communications. *Preqs.: CSE 454 or CSC 312 or ECE 340; CSE 459 or ECE 301. 3(3-0) S.* Deals with the principles and techniques of moving digital data through transmission facilities. To be covered: digital information representation; characteristics of channels; modulation and demodulation (MODEM) techniques; error detection and correction; line control procedure; circuit, message and packet switching; multiplexors and concentrators.

CSE (CSC, ECE) 572 Computer Communications. *Preq.: CSC 312 or ECE 340 or CSE 454; Coreq.: B average in technical subjects. 3(3-0) F.* The purpose of this course is to enable the student to understand the principles, the control and operations and the potential of computer communication systems; to present techniques for topological design and analytic modeling of such systems; and to provide the foundation for more detailed studies and research. The courses are self-contained and focus on practical applications of state-of-art techniques.

CSE (CSC, ECE) 574 Real Time Computer Systems. *Preq.: CSC 405 or CSE (CSC, ECE) 501. 3(3-0) Alt. S.* Hardware and software characteristics of computer systems designed to meet specific response time requirements are studied. Topics include allocation of system resources including processor memory, disk, support I/O devices; synchronous and asynchronous event scheduling; effect of interrupts; static and dynamic priorities; implementation of queues; measurement of performance, especially scheduling and response accuracy.

CSE 591 Special Topics in Computer Studies. *Preqs.: B average in technical subjects and CI. 3(3-0) F,S.* Topics of current interest in computer studies not covered in existing courses.

FOR GRADUATES ONLY

CSE (OR) 605 Large Scale Linear Programming Systems. *3(3-0) Alt. S.* (See operations research.)

CSE (ECE) 640 Advanced Logic Systems. *3(3-0) S.* (See electrical and computer engineering.)

CSE (ECE) 641 Sequential Machines. *3(3-0) F.* (See electrical and computer engineering.)

CSE (ECE) 651 Statistical Communication Theory. *3(3-0) S.* (See electrical and computer engineering.)

CSE (ECE) 652 Information Theory. *3(3-0) F.* (See electrical and computer engineering.)

CSE (CSC, ECE) 671 Computer Systems Performance Evaluation. *Preqs.: CSE 506, MA 421 or CI. 3(3-0) Alt. S.* Emphasis on the use of analysis and simulation techniques for performance evaluation of computer systems, in particular, communication based and real time systems. To be covered: overview of the performance evaluation techniques; relevant statistics elements; basic queueing models; single component with single jobs; communication based computer systems; real time data processing systems; time sharing and multiprogramming systems; distributed systems.

CSE (MA) 679, 680 Advanced Numerical Analysis I, II. *3(3-0) F,S.* (See mathematics.)

CSE 691 Advanced Topics in Computer Studies. *Preqs.: Grad. standing, CI. 3(3-0) F,S.* Advanced topics of current interest in computer studies not covered by existing courses.

CSE 693 Individual Topics in Computer Studies. *Preqs.: Grad. standing, CI. 1-3 F,S.* An opportunity for an individual graduate student to investigate special topics of interest under the direction of members of the graduate faculty.

CSE 695 Seminar in Computer Studies. *Preqs.: Grad. standing, CI. 1(1-0) F,S.* Seminar discussion of problems of current research interests in computer studies. Seminar speakers consist of advanced graduate students, faculty, and invited speakers.

CSE 699 Computer Studies Research. *Preqs.: Grad. standing, CI. Credits Arranged. F,S.* Individual research by graduate students minoring and majoring in computer studies. Research may be done under the supervision of CSE faculty members meeting the interest and need of the student.

Counselor Education

For a listing of graduate faculty and departmental information, see counselor education under education.

Crop Science

GRADUATE FACULTY

Professor B. E. Caldwell, Head

Professors: D. S. Chamblee, H. D. Coble, W. K. Collins, F. T. Corbin, D. A. Emery— *Coordinator, Graduate Programs*, W. T. Fike, W. B. Gilbert, H. D. Gross, W. M. Lewis, R. C. Long, T. J. Mann, R. P. Patterson, L. L. Phillips, T. J. Sheets, G. A. Sullivan, D. H. Timothy, J. B. Weber, E. A. Wernsman, A. D. Worsham, J. C. Wynne; *Extension Professor:* G. L. Jones—*In Charge, Crop Science Extension*; *Professors (USDA):* J. C. Burns, J. F. Chaplin, W. A. Cope, G. R. Gwynn, J. A. Lee, D. E. Moreland; *Adjunct Professor:* L. Thompson Jr.; *Professors Emeriti:* C. T. Blake, D. U. Gerstel, W. C. Gregory, P. H. Harvey, K. R. Keller, G. K. Middleton, R. P. Moore, D. L. Thompson, J. A. Weybrew; *Professor Emeritus (USDA):* C. A. Brim; *Associate Professors:* E. J. Dunphy, J. T. Green Jr., J. P. Mueller, G. F. Peedin, H. T. Stalker Jr., W. W. Weeks; *Associate Professors (USDA):* J. W. Burton, S. C. Huber, R. F. Wilson; *Assistant Professors:* J. R. Anderson, J. M. DiPaola, R. D. Keys, S. M. Reed, A. C. York; *Assistant Professors (USDA):* J. M. Anderson, T. E. Carter Jr.

The Department of Crop Science offers instruction leading to the Master of Science and Doctor of Philosophy degrees in the fields of plant breeding, crop production and physiology, forage crops ecology, weed control and plant chemistry. For students who wish general training, the Master of Agriculture is offered.

Excellent facilities for graduate training are available. Many special facilities such as preparation rooms for plant and soil samples, cold storage facilities for plant material, greenhouse space, growth control chambers and access to computer facilities and the plant environment laboratory (Phytotron) are provided if required. Sixteen farms are owned and operated by the State for research investigations. Research farms are located throughout North Carolina and include a variety of soil and climatic conditions needed for experiments in plant breeding, crop management, forage ecology and weed control.

Strong supporting departments increase opportunities for broad and thorough training. Among the departments in which graduate students in crop science work cooperatively or obtain instruction are Biochemistry, Botany, Chemistry, Computer Science, Entomology, Horticultural Science, Genetics, Mathematics, Microbiology, Plant Pathology, Soil Science and Statistics.

In North Carolina, a state which derives 60 to 65 percent of its agricultural income from farm crops, the opportunities for the well-trained agronomist are great. Recipients of advanced degrees in crop science at North Carolina State University are found in positions of leadership in research and education throughout the nation and the world.

SELECTED ADVANCED UNDERGRADUATE COURSES

CS 411 Environmental Aspects of Crop Production. *Preq.: BO 421. 2(2-0) F.*

CS 413 Plant Breeding. *Preq.: GN 411. 2(2-0) S.*

CS 414 Weed Science. *Preq.: CH 220. 4(3-2) F.*

CS (SSC) 462 Soil-Crop Management Systems. *Preqs.: CS 211, CS 414, SSC 341, SSC 342, SSC 352, Sr. standing. 3(2-3) S.*

CS 490 Senior Seminar in Crop Science. *Preq.: Sr. in crop science or related field. 1(1-0) S.*

CS (HS) 492 Topics in Plant Breeding. *1(0-2) S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

CS 511 Tobacco Technology. *Preq.: BO 421 or equivalent. 3(3-0) S.* A study of special problems concerned with the tobacco crop. The latest research problems and findings dealing with this important cash crop will be discussed.
Collins

CS 513 Physiological Aspects of Crop Production. *Preq.: BO 421. 3(3-0) S.* Discussion will emphasize pertinent physiological processes associated with crops and crop management such as plant growth, maturation, respiration and photoperiodism. Relationship of the environment to maximum crop yields will be discussed. (Offered S 1984 and alt. years.)
Fike

CS (HS) 514 Principles and Methods in Weed Science. *Preq.: CS 414 or equivalent. 3(2-2) S.* Studies of the losses caused by the ecology of weeds, biological control basic concepts of weed management, herbicide-crop relationships and herbicide development. Introduction to greenhouse and bioassay techniques and field research techniques.
Monaco

CS (BO, ENT, PM, PP) 525 Biological Control. *4(3-3) Alt. F.* (See pest management.)

CS (GN, HS) 541 Plant Breeding Methods. *Preqs.: GN 506, ST 511. 3(3-0) F.* An advanced study of methods of plant breeding as related to principles and concepts of inheritance.
Wehner, Wynne

CS (GN, HS) 542 Plant Breeding Field Procedures. *Preq.: CS (GN, HS) 541. 2(0-4) Sum.* Laboratory and field study of the application of the various plant breeding techniques and methods used in the improvement of economic plants. (Offered Sum. by arrangement.)
Graduate Staff

CS (GN) 545 Origin and Evolution of Cultivated Plants. *Preq.: GN 505 or GN (ZO) 540. 3(3-0) Alt. S.* Review of progression to modern evolutionary thought; concepts of speciation and classification; origin of variation in plants; theories relating to origins of cultivation and spread of agriculture; variation patterns and special attributes of cultigens; interactions of crops and environments; evolution under domestication; modern aspects of evolution as related to breeding. (Offered S 1984 and alt. years.)
Stalker

CS 591 Special Problems. *Preq.: CI. Credits Arranged. F,S,Sum.* Special problems in various phases of crop science. Problems may be selected or will be assigned. Emphasis will be placed on review of recent and current research.
Graduate Staff

FOR GRADUATES ONLY*

CS 611 Metabolism and Crop Productivity. *Preqs.: BCH 451; BO 551 or 552. 3(3-0) Alt. S.* The course attempts to demonstrate the integration of basic metabolic processes to crop growth and quantitative and qualitative aspects of productivity. Where applicable, special

*Students are expected to consult with the instructor before registration.

emphasis is given to the interaction of genotype and environment with these processes. (Offered S 1985 and alt. years.) Long

CS (GN, HS) 613 Plant Breeding Theory. *Preqs.: CS (GN, HS) 541, GN 506, ST 512. 3(3-0)* S. A study of theoretical bases for plant breeding procedures with special emphasis on the relationship between type and source of genetic variability, mode of reproduction and effectiveness of different selection procedures. The latest experimental approaches to plant breeding will be discussed as well as standard procedures. (Offered S 1984 and alt. years.) Wernsman

CS (HS, SSC) 614 Herbicide Behavior in Plants and Soils. *Preqs.: BO 551 and CH 223 or CI. 3(3-0) F.* The chemical and physiological processes involved in the behavior of herbicides in plants and soils will be examined. Topics to be discussed include absorption, translocation, metabolism and mechanisms of action of herbicides on plants; reactions, movement and degradation of herbicides in the soil; and interactions among herbicides and other pesticides. (Offered F 1985 and alt. years.) Weber

CS 690 Seminar. *Preq.: Grad. standing. 1(1-0) F,S.* A maximum of two credits is allowed toward the master's degree; however, additional credits toward the doctorate are allowed. Scientific articles, progress reports in research and special problems of interest to agronomists are reviewed and discussed. Graduate Staff

CS 699 Research. *Preq.: Grad. standing. Credits Arranged.* A maximum of six credits is allowed toward the master's degree, but no restrictions toward the doctorate. Graduate Staff

Curriculum and Instruction

For a listing of graduate faculty and departmental information, see education.

Design

For a listing of graduate faculty and departmental information, see architecture, landscape architecture, product design.

SELECTED ADVANCED UNDERGRADUATE COURSES

DN 411 Advanced Visual Laboratory. *Preqs.: DF 102, soph. standing. 3(0-6) F,S.*

DN 412 Advanced Photography. *Preq.: DN 312. 3(1-4) S.*

DN 413 Synthetic Drawing. *Preq.: DF 102. 3(2-3) F.*

DN 414 Color and Light Laboratory. *Preq.: DF 102. 3(2-2) F,S.*

DN 418 Ideation II. *Preq.: DN 318. 3(2-2) S.*

DN 419 Multi-Media in Design. *Preq.: DN 212. 3(1-4) S.*

DN 421 Environmental Cognition for Designers. *Preqs.: DN 221/231 or DN 222. 3(3-0) F.*

DN 423 Spatial Cognition for Designers. *Preqs.: DN 221/231 or DN 222. 3(3-0) F.*

- DN 424 Social Factors Analysis in Design.** *Preqs.: DN 221/231 or DN 222. 3(2-4) S.*
- DN 430 Site Planning.** *Preqs.: DN 221/231 and MEA 120/110 or MEA 101/110 or SSC 205. 3(2-2) F,S.*
- DN 431 Natural Environment Analysis.** *Preqs.: DN 221/231 or DN 232. 3(3-0) F.*
- DN 432 Environmental Assessment and Design Field Workshop.** *Preqs.: DN 221/231 or DN 232. 3(3-0) Sum.*
- DN 433 Native Plants in Environmental Design.** *Preqs.: DN 221/231 or DN 232, HS 211. 3(2-2) S.*
- DN 441 Origins and Development of Contemporary Architecture.** *Preqs.: DN 141, 142 for Design students only; others, jr. standing. 3(3-0) F,S.*
- DN 443 Landscape History: From the Ice Age to the Present.** *Preqs.: DN 141, 142. 3(3-0) F.*
- DN 444 History of Landscape Architecture.** *Preqs.: DN 141, 142. 3(3-0) F.*
- DN 445 Aesthetics and Design.** *Preq.: DN 141 or DN 142. 3(3-0) F.*
- DN 446 History of Building Types.** *Preqs.: DN 141, 142, 254. 3(3-0) F.*
- DN 448 Ideas in American Architecture II: 1893-1918.** *Preq.: Jr. standing. 3(3-0) S. Alt. yrs.*
- DN 449 Urban Form and Structure.** *Preq.: Jr. standing. 3(3-0) F.*
- DN 451 Illumination.** *Preq.: DN 253. 3(1-4) S.*
- DN 452 Climate Control Systems and Design.** *Preq.: DN 253. 3(1-4) F.*
- DN 453 The Systems Approach to Building.** *Preq.: DN 254. 3(3-0) S.*
- DN 454 Geometry for Designers.** *Preq.: DF 102. 3(2-3) S.*
- DN 455 Visual Design Materials and Processes I.** *Preq.: DF 102. 3(2-2) S.*
- DN 456 Visual Design Materials and Processes II.** *Preq.: DF 102. 3(2-2) S.*
- DN 462 Predictive Techniques, Predesign Methods, and Programming.** *Preq.: DN 261. 3(3-0) S.*
- DN 491 Special Seminar in Design.** *1-3 F,S.*
- DN 492 Special Topics in Design.** *1-3 F,S.*
- DN 493 Mini-Course in Design.** *1-2 F,S.*
- DN 494 Internship in Design.** *Preqs.: Jr. standing, approval of program director. 3-6 (Max. 6) F,S.*
- DN 495 Independent Study in Design.** *Preqs.: Jr. standing, approval of program director and core chairman. 1-3 (Max. 6) F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

DN 541 Seminar on Ideas in Design. *Preq.: Grad. standing. 2-3 F,S.* An examination of aesthetics and the relationships of philosophic thought to design.

FOR GRADUATES ONLY

DN 611 Advanced Visual Laboratory. *Preq.: Grad. standing; may be taken for a maximum of 12 credit hours. 2-4 F,S.* Advanced experimental studies in visual phenomena related to design.

DN 698 Design Research and Service Learning Projects. *Preqs.: Grad. standing, consent of program director and graduate committee. 2-6 F,S,Sum.* Problems relevant to design will provide the subjects for graduate study based upon research, service learning projects, on- and off-campus internships and individual investigations will be under the direction of faculty advisors.

Ecology**GRADUATE FACULTY**

Professor E. D. Seneca, Chairman

Professors: S. P. S. Arya, R. C. Axtell, K. R. Barker, U. Blum, J. R. Bradley Jr., S. W. Buol, D. S. Chamblee, A. W. Cooper, B. J. Copeland, G. H. Elkan, L. F. Grand, H. D. Gross, F. E. Guthrie, T. O. Perry, R. E. Stinner, H. R. van der Vaart, A. G. Wollum II, A. D. Worsham; *Professor (USDA):* J. C. Burns; *Professor (USDI):* M. T. Huish; *Professor Emeritus:* D. W. Hayne; *Associate Professors:* D. A. Adams, D. M. Benson, P. D. Doerr, D. J. Frederick, F. P. Hain, B. C. Haning, D. Kamykowski, G. G. Kennedy, J. M. Miller, S. C. Mozley, K. H. Pollock, L. A. Real, J. F. Reynolds, T. R. Wentworth; *Assistant Professors:* F. A. Benford, F. Gould, R. A. Lancia, R. A. Powell

Ecology is the science concerned with the interactions of organisms with each other and with their environment. It is an integrative science through which one gains an understanding of biological and physical interrelationships and predicts the consequences of altering one or several components of an ecosystem.

Students in a number of basic and applied curricula may elect to major in ecology at the master's level leading to an M.S. degree or minor in ecology at the master's and Ph.D. levels. The minor provides an opportunity for a coherent picture of the field of ecology but does not usurp the normal prerogatives of graduate advisory committees in structuring graduate programs.

The ecology minor is an interdepartmental program drawing faculty from the botany, crop science, entomology, forestry, marine, earth and atmospheric sciences, microbiology, plant pathology, soil science, statistics and zoology departments. The program is administered by the Ecology Advisory Committee. Additional information about the program may be obtained by writing to one of the faculty members listed above or to Chairman, Ecology Faculty, P. O. Box 5186, North Carolina State University, Raleigh, North Carolina 27650.

The following courses are recognized as ecological and have been grouped into certain related areas. (For course descriptions, see respective departmental listings.)

General Ecology: BO (ZO) 560 Principles of Ecology; BO 565 Plant Community Ecology; BO (ZO) 660 Advanced Topics in Ecology I; ZO (BO) 661 Advanced Topics in Ecology II.

Population Ecology: ZO 517 Population Ecology; ENT 531 Insect Ecology.

Limnology and Marine Science: ZO 419 Introduction to Limnology; ZO 509 Ecology of Stream Invertebrates; ZO (MEA) 520 Principles of Biological Oceanography; ZO 619 Advanced Limnology.

Behavior: ZO 410 Introduction to Animal Behavior; ZO 501 Ornithology; ZO 691 Topics in Animal Behavior.

Microbial Ecology: MB 501A,B,C Advanced Microbiology I (A-Metabolism; B-Physiology; C-Immunology); MB 503 Microbial Ecology; SSC (MB) 532 Soil Microbiology; PP 611 Advanced Plant Nematology; PP (BO) 625 Advanced Mycology; SSC (MB) 632 Ecology and Functions of Soil Microorganisms.

Terrestrial Ecology: BO 544 Plant Geography; ZO 544 Mammalogy; SSC 551 Soil Morphology, Genesis and Classification; MEA 555 Meteorology of the Biosphere.

Physiological Ecology: ZO (PHY) 513 Comparative Physiology; ZO (FW) 515 Growth and Reproduction of Fishes; BO 561 Physiological Ecology.

Mathematical Biology and Ecology: ZO (FW) 553 Principles of Wildlife Science; BO 570 Quantitative Ecology; BMA (MA, ST) 571, 572 Biomathematics I, II.

Applied Ecology: CS 411 Environmental Aspects of Crop Production; ZO 420 Fishery Science; ZO 441 Ichthyology; FOR 452 Silvics; FOR 472 Renewable Resource Management; SSC 472 Forest Soil; HS (CS) 514 Principles and Methods in Weed Science; TOX 515 Environmental Toxicology; ENT 550 Fundamentals of Insect Control; ZO (FW) 554 Wildlife Field Studies; ENT 562 Insect Pest Management in Agricultural Crops; ENT (ZO) 582 Medical and Veterinary Entomology; FOR 613 Special Topics in Silviculture; FOR 614 Advanced Topics in Administration of Forest Resources; BO 662 Applied Coastal Ecology.

The requirements for a major in Ecology are:

Master of Science Degree: Six courses including BO (ZO) 560 (or its equivalent), either BO 565, BO (ZO) 660 or ZO(BO) 661, ST 511, ECO 690 and one course from each of two designated areas (population ecology, limnology and marine science, etc.). The latter two courses should not be in the same department as the major professor.

The requirements for a minor in Ecology are:

Master of Science Degree: Three ecological courses, including BO (ZO) 560 (or its equivalent) and either BO 565, BO (ZO) 660 or ZO (BO) 661. The third course should not be in the same department as the major.

Ph.D. Degree: Four ecological courses, including BO (ZO) 560 (or its equivalent) and at least one other course from the general ecology area. One course outside the general ecology area is required. If more than one course is taken from outside the general ecology area, these courses must come from different designated areas (i.e., population ecology,

limnology and marine science, etc.). Courses outside the general ecology area should not be from the same department as the major.

Incoming students may apply equivalent courses toward these requirements at the discretion of their graduate committees. Students minoring in ecology, particularly at the Ph.D. level, are encouraged to take courses in mathematics and statistics, at least ST 511 and ST 512.

FOR GRADUATES ONLY

ECO 690 Ecology Seminar. *Preq.: Grad. standing. 1(1-0) F.* Scientific articles, progress reports and special problems of interest to ecologists are reviewed and discussed. Minimum of one seminar presentation required for credit.

ECO 693 Special Problems in Ecology. *Preq.: Grad. standing. 1-6 F,S,Sum.* Investigation of special problems in ecology of particular interest to advanced students under the direction of a faculty member. Directed research in some specialized phase of ecology other than a thesis problem, but designed to provide experience and training in research.

Economics and Business

GRADUATE FACULTY

Professor D. M. Hoover, Head

Professors: G. A. Carlson, R. L. Clark, A. J. Coutu, R. D. Dahle, E. W. Erickson, R. M. Fearn, D. Fisher, A. R. Gallant, D. M. Holthausen Jr., D. N. Hyman, L. A. Ihnen, M. A. Johnson—*Associate Head and Extension Specialist In Charge*, P. R. Johnson, T. Johnson, C. P. Jones, E. W. Jones, R. A. King, C. J. Messere—*Associate Head for Accounting*, T. E. Nichols Jr., B. M. Olsen—*Director, Center for Economic and Business Studies*, E. C. Pasour Jr., R. J. Peeler, R. K. Perrin—*Associate Head for Agricultural Research and Teaching*, R. A. Schrimper, J. A. Seagraves, R. L. Simmons, R. E. Sylla, W. D. Toussaint, C. B. Turner; *Extension Professors:* H. L. Liner, C. R. Pugh, R. C. Wells—*Associate Director of Extension*; *Professors Emeriti:* R. C. Brooks, J. G. Sutherland, J. C. Williamson Jr.; *Associate Professors:* S. G. Allen, D. S. Ball, J. S. Chappell, L. E. Danielson, J. E. Easley Jr., D. J. Flath, D. M. Grant, T. J. Grennes, C. W. Harrell Jr., D. L. Holley Jr., C. R. Knoeber, J. S. Lapp—*Associate Head for Economics and Business*, M. B. McElroy—*Assistant Head and Graduate Administrator*; J. C. Poindexter Jr., J. J. Seater, D. A. Sumner, M. L. Walden, W. J. Wessels, J. W. Wilson, G. J. Zuckerman; *Associate Professors (USDA):* H. C. Gilliam Jr., L. B. Perkinson; *Assistant Professors:* D. L. Baumer, G. A. Benson, B. Bublit, M. J. Courchane, J. C. Dutton Jr., E. A. Estes, N. M. Garren, D. L. Kendall, J. W. Levedahl, S. E. Margolis, R. P. Moffie, R. B. Palmquist, J. E. Standaert

The Department of Economics and Business offers programs of study leading to the Master of Economics, the Master of Arts in economics, the Master of Science in agricultural economics, the Master of Science in management (in conjunction with

other departments) and the Ph.D. degree in economics. Emphasis is placed on economic theory and quantitative economic analysis and their application to economic problems. Special seminars and workshops are available to students as a means of pursuing topics of special interest.

Master's programs require a minimum of 30 semester hours. A semester each of intermediate undergraduate micro and macro theory in addition to basic calculus are minimum prerequisites. Except for the Master of Science in management degree, a nine-hour minor (within the 30 hours) is required in some discipline outside the department. No foreign language is required. A six-credit-hour thesis is required for the degrees of Master of Arts in economics and the Master of Science in agricultural economics. A thesis is not required for the other Master's degrees. Course work concentrations may be developed in a number of traditional economics areas (see Ph.D. program description) as well as in management areas. The Master of Science in management requires 30 semester hours, 12 of which are in required core courses. Prerequisites are undergraduate micro and macro theory and a year of calculus. Six undergraduate foundations courses are also required in basic management areas. A technical option in one of the seven departments offering the degree is a part of the graduate program. The technical option in Economics and Business can be focused on finance, quantitative marketing, labor economics and other areas. A project paper is required at the end of the program.

The Ph.D. program has no specific hour requirements; however, at least six semesters of work beyond the bachelor's degree are required, of which at least two consecutive semesters must be in residence. Candidates take course work and written examinations in economic theory and a minor of their choice. In addition, each student chooses a field of study within the department (*e.g.*, agricultural economics, economic development, econometrics, international trade, labor economics and human resources or managerial economics). A minimum of two semesters of statistics and differential and integral calculus is required of all Ph.D. candidates. There is no foreign language requirement for the Ph.D. Specific programs are designed to meet individual interests and professional objectives.

A well-equipped departmental library, the D. H. Hill Library and library facilities of two nearby major universities are readily available for graduate student use. Graduate students on financial support are provided office space. Computational facilities are available for students whose research involves extensive analysis of data and to students interested in learning to use computer facilities. The department has a specially trained clerical and programming staff. Students have access from several terminals on campus to an IBM 370/165 operated by the Triangle Universities Computing Center.

SELECTED ADVANCED UNDERGRADUATE COURSES

EB 401 Economic Analysis for Nonmajors. *Preq.: EB 201 or 212. 3(3-0) F,S.*

EB 404 Money, Financial Markets, and the Economy. *Preq.: EB 302. 3(3-0) F,S.*

EB 410 Public Finance. *Preq.: EB 301. 3(3-0) F.*

EB 413 Competition, Monopoly and Public Policy. *Preq.: EB 301. 3(3-0) S.*

EB 415 Farm Appraisal and Finance. *Preq.: EB 303 or 310. 3(2-2) F.*

EB 420 Corporation Finance. *Preqs.: EB 201 or 212 and ACC 260 or 265. 3(3-0) F,S.*

EB 422 Investments and Portfolio Management. *Preqs.: EB 201 or EB 212; EB 350 or a grade of C or better in ST 311. 3(3-0) F,S.*

EB 430 Agricultural Price Analysis. *Preq.: EB 301. 3(3-0) F.*

EB 431 Labor Economics. *Preq.: EB 301. 3(3-0) F,S.*

EB 435 Urban Economics. *Preq.: EB 301. 3(3-0) F,S.*

EB 436 Environmental Economics. *Preq.: EB 301. 3(3-0) S.*

EB 442 Evolution of Economic Ideas. *Preq.: EB 202 or 212. 3(3-0) F.*

EB 448 International Economics. *Preq.: EB 301. 3(3-0) F,S.*

EB 451 Introduction to Econometrics. *Preqs.: EB 301, 302, 350. 3(3-0) F.*

EB 475 Comparative Economic Systems. *Preq.: EB 201 or 212. 3(3-0) F,S.*

EB (TX) 482 Textile Marketing Management. *Preqs.: EB 301, EB 313, TX 380. 3(2-2) F,S.*

EB (WPS) 485 Management Development Seminar. *Preq.: EB 201 or 212.* This course may not be used for credit toward an economics minor for any graduate degree. 3(3-0) S.

EB 490 Senior Seminar in Economics. *Preqs.: EB 301, 302, 350 and two courses from list of restricted electives. All prerequisites must be passed with grades of C or better before taking EB 490. 3(3-0) F,S.*

EB 491 Senior Seminar in Economics. *Preq.: EB 490. 3(3-0) F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

EB 501 Price Theory. *Preqs.: MA 113 and EB 301. 3(3-0) F,S.* An intensive analysis of the determination of prices and of market behavior, including demand, cost and production, pricing under competitive conditions and pricing under monopoly and other imperfectly competitive conditions.
Graduate Staff

EB 502 Income and Employment Theory. *Preqs.: MA 113, EB 301 and 302. 3(3-0) F,S.* A study of the methods and concepts of national income analysis with particular reference to the role of fiscal and monetary policy in pursuit of full employment without inflation.
Graduate Staff

EB (RRA) 503 Economics of Recreation. 3(3-0) F. (See recreation resources administration.)

EB 512 Law and Economics. *Preq.: EB 301 or EB 401. 3(3-0) Alt. F.* An economic analysis of the sources and effects of law, including common law, statutory law and regulation. Topics discussed include property rights and contracts, liability rules, crime and punishment, statutory enactment, bureaucratic behavior and institutional reform. Baumer, Knoeber

EB 513 Research Methods in Marketing. *Preqs.: EB 313, EB 350, EB 501. 3(3-0) S.* A systematic approach to the structure, implementation and analysis of marketing research

for decision making. Models of consumer demand and firm behavior analyzed in a marketing context.
Courchane, Levedahl

EB 515 Environmental and Resource Policy. *Preq.: EB 301 or EB 401. 3(3-0) Alt. F.* Application of price theory and benefit-cost analysis to public decisions related to resources and the environment. Emphasis on evaluation of water supply and recreation investments, water quality management alternatives, public-sector pricing, common property resources and optimum management of forest and energy resources.
Seagraves

EB 520 Managerial Finance: Theory and Applications. *Preqs.: EB 420 and EB 301 or 401. 3(3-0) S.* The foundations of finance theory and the empirical evidence available regarding the theory. Applications of basic finance theory, including capital budgeting, markets, valuation, cost of capital, financing alternatives, dividend policy and management of liquid assets. The micro-finance decisions made by a firm, primarily the investment, financing and dividend decisions.
Jones

EB 521 Markets and Trade. *Preq.: EB 301 or 401. 3(3-0) F.* This course emphasizes the space, form and time dimensions of market price and the location and produce combination decisions of firms. Consideration is given to the way in which non-price factors and public policy choices influence firm behavior and the efficiency of marketing systems. Application of these models to agricultural, industrial and public service questions is emphasized, including the relationships between resource availability and the spatial arrangement of economic activity.
King

EB 522 Portfolio and Capital Market Theory. *Preqs.: EB 501 and EB 350 or ST 311. 3(3-0) F.* Portfolio theory and its applications, plus capital market theory and the equilibrium pricing of financial assets. The role of securities, utility theory and analysis of secondary markets and their efficiency and the definition and measurement of returns and risks. Valuing securities, including options contracts.
Grant, Jones

EB 523 Planning Farm and Area Adjustments. *Preqs.: EB 301, 303 or 401. 3(2-2) S.* The application of economic principles to production problems on typical farms in the state; methods and techniques of economic analysis of the farm business; application of research findings to production decisions; development of area agricultural programs.
Coutu

EB 525 Managerial Economics. *Preq.: EB 301 or 401. 3(3-0) Alt. S.* Applications of economic theory to the study of selected business practices in realms of finance, marketing, and management decision making. Specific topics have included: capital budgeting, financial structure, government regulation of industry, pricing strategies, tie-in sales, contractual arrangements between manufacturers and retailers, comparisons of managerial behavior in nonprofit or government enterprise to that in for-profit firms.
Flath

EB 532 Economics of Trade Unions. *Preq.: EB 301 or 401. 3(3-0) Alt. F.* An examination of the growth of the trade union movement in the United States. Primary consideration is given to the impact of unions on the economy through their influence on wages, prices, employment and resource allocation. Other topics include the relationship between the government and unions, the changing compensation mix and the recent growth in public employee unionism.
Allen, Clark

EB 533 Agricultural Policy. *Preq.: EB 301 or 401. 3(3-0) S.* A review of the agricultural policy and action programs of the federal government affecting both input supply and commodities. An analysis of objectives, principal means and observable results on resource use and income distribution within agriculture, and between agriculture and the rest of the economy. An appraisal of the effects alternative policy proposals would have on domestic and foreign consumption.
Hoover, Pasour

EB 540 Economic Development. *Preq.: EB 301 or 401. 3(3-0) Alt. S.* An examination of the problems encountered in promoting regional and national economic development. Consideration is given to the structural changes required for raising standards of living. Some basic principles of economics are applied to suggest ways of achieving development goals. Topics include planning strategies, policies and external assistance. Olsen, Sumner

EB 551 Agricultural Production Economics. *Preqs.: MA 113 and EB 301 or EB 401. 3(3-0) S.* An economic analysis of agricultural production including: production functions, cost functions, programming and decision-making principles. Applications of these principles to farm and regional resources allocation, and to the distribution of income to and within agriculture. Carlson, Perrin

EB (ST) 561 Intermediate Econometrics. *Preqs.: EB 501 and ST 513. 3(3-0) S.* The formalization of economic hypotheses into testable relationships and the application of appropriate statistical techniques will be emphasized. Major attention will be given to procedures applicable for single equation stochastic models expressing microeconomic and macroeconomic relationships. Statistical considerations that are relevant in working with time series and cross sectional data in economic investigations will be covered. Survey of simultaneous equation models and the available estimation techniques.

P. Johnson, Schrimper

EB 570 Analysis of American Economic History. *Preq.: EB (HI) 371 or grad. standing or PBS status. 3(3-0) Alt. S.* Stresses the application of economic analysis to the formulation and testing of hypotheses concerning economic growth and development in the historical context. Problems selected for analysis will be drawn primarily from American economic history. Sylla

EB (SOC) 574 The Economics of Population. *Preq.: EB 301 or 401. 3(3-0) S.* A review of population theories from the pre-Malthusian to the contemporary. An introduction to demographic data sources and analysis. Microeconomic models of fertility are intensively treated, and macroeconomic demographic models also are examined. The public policy implications of these models are developed. Discussions include underpopulation, overpopulation, optimum growth rate and incentive schemes. Graduate Staff

EB (TX) 585 Market Research in Textiles. *3(3-0) S.* (See textile materials and management.)

EB 590 Special Economics Topics. *Preq.: CI. Maximum 6. F,S,Sum.* An examination of current problems on a lecture-discussion basis. Course content will vary as changing conditions require new approaches to deal with emerging problems. Graduate Staff

EB 598 Topical Problems in Economics. *Preq.: CI. 1-6. F,S,Sum.* An investigation of topics of particular interest to advanced students under faculty direction on a tutorial basis. Credits and content vary with student needs. Graduate Staff

FOR GRADUATES ONLY

EB 600 Advanced Price Theory. *Preqs.: EB 501, MA 212. 3(3-0) F.* Alternative economic organizations and the role of prices; equilibrium and price determination in a market economy; theory of consumer behavior, derivation of individual demand curves and aggregation to market supply curves; demand for factors of production. Graduate Staff

EB 601 Prices, Value and Welfare. *Preq.: EB 600. 3(3-0) S.* The supply of factors of production; alternative nonmonetary theories of capital and interest; productivity; income

distribution; determinants of firm size; the nature of market organization; welfare economics topics, including externalities, compensation, social welfare function and consumer surplus.

Graduate Staff

EB 602 Advanced Income and Employment Theory. *Preqs.: EB 502. 3(3-0) F.* An analysis of the forces determining the level of income and employment; a review of some of the theories of economic fluctuations; and a critical examination of a selected macroeconomic system.

Graduate Staff

EB 603 History of Economic Thought. *Preqs.: EB 501 and 502 or equivalent. 3(3-0) Alt. Sum.* A systematic analysis of the development and cumulation of economic thought, designed in part to provide a sharper focus and more adequate perspective for the understanding of contemporary economics.

Turner, Wilson

EB 604 Monetary Economics. *Preq.: EB 502 or equivalent. 3(3-0) S.* Consideration of the money market and portfolio management, the cost of capital, effects of monetary phenomena on investment and accumulation of wealth with emphasis throughout on problems arising from uncertainty; general equilibrium theory of money, interest, prices and output.

Graduate Staff

EB 606 Industrial Organization and Control. *Preq.: EB 501. 3(3-0) F.* Microeconomic theory is applied to the empirical analysis of public policies that affect the efficiency of resource allocation in the U. S. economy. Special attention is given to the interrelationships between industrial structure, conduct and performance.

Flath, Margolis

EB 610 Theory of Public Finance. *Preq.: EB 501. 3(3-0) S.* An application of microeconomic theory and welfare economics to the public sector. Topics include externalities and public policy, the theory of public goods, collective choice, program budgeting and cost-benefit analysis, the theory of taxation and its application to tax policy, public debt, and fiscal federalism.

Hyman

EB 615 Environmental and Resource Economics. *Preq.: EB 501. 3(3-0) Alt. S.* The theoretical tools and empirical techniques necessary for an understanding of resource and environmental economics, developed in both a static and dynamic framework. Discussions of the causes of environmental problems, possible policies and approaches to nonmarket valuation. Analysis of resource use over time using control theory for both renewable and exhaustible resources.

T. Johnson, Palmquist

EB 625 Long Range Planning in Business and Industry. *Preq.: EB 501. 3(3-0) F.* Theory and practice of long range planning in business and industry. Case discussions and intensive readings dealing with techniques for identifying opportunities and risks in the environment of the firm, determining corporate strengths and weaknesses, specifying long range strategy. Special attention is given to the roles of management and the internal processes of large organizations as the organizations respond to changes in external conditions.

Holthausen

EB 630 Labor Economics and Manpower Problems. *Preqs.: EB 501, 502. 3(3-0) S.* The analysis of labor force problems and labor market behavior. Labor force measurement and behavior, the measurement and analysis of unemployment, the determinants of relative wages, wage structures, and hours of work and national manpower policy. Emphasis on empirical studies.

Allen, Clark, Fearn

EB 631 Human Capital. *Preqs.: EB 501, 502. 3(3-0) F.* An examination of human resource development from an economic view. Emphasis is placed on recent research and theoretical developments in the economics of education, on-the-job training, discrimination and migration.

Ihnen, Wessels

EB 640 Advanced Economic Development. *Preqs.: EB 501, 502, 540. 3(3-0) Alt. F.* An analysis of the factors determining the growth of poorer countries and regions of countries. Consideration is given to issues that have arisen in current theoretical and empirical bases for policy decisions. Included in the latter elements are the quantitative foundations for planned and programmed development. Applications of alternative planning methods are evaluated.
Coutu, King

EB 641 Agricultural Production and Supply. *Preqs.: EB 501 and ST 513. 3(3-0) F.* An advanced study in the logic of, and empirical inquiry into, producer behavior and choice among combinations of factors and kinds and qualities of output; aggregative consequences of individuals' and firms' decisions in terms of product supply and factor demand; factor markets and income distribution; and general interdependency among economic variables. Perrin

EB 642 Consumption, Demand and Market Interdependency. *Preqs.: EB 501 and ST 513. 3(3-0) S.* An analysis of the behavior of individual households and of consumers in the aggregate with respect to consumption of agricultural products; the impact of these decisions on demand for agricultural resources, the competition among agricultural regions and for markets; and the interdependence between agriculture and other sectors of the economy.
King, Wohlgenant

EB 648 Theory of International Trade. *Preqs.: EB 501, 502. 3(3-0) S.* A consideration of the specialized body of economic theory dealing with the international movement of goods, services, capital and payments. Also, a theoretically oriented consideration of policy.
P. Johnson

EB 649 Monetary Aspects of International Trade. *Preq.: EB 502. 3(3-0) F.* Study of the macroeconomic problems of an open economy including the balance of payments adjustment mechanism, alternative exchange rate systems, external effects of monetary and fiscal policy, optimum currency areas and international monetary reform.
Grennes

EB 650 Economic Decision Theory. *Preq.: EB 501. 3(3-0) S.* Study of general theories of choice. Structure of decision problems, the role of information; formulation of objectives. Current research problems.
Carlson, Holthausen

EB (ST) 651 Econometrics. *Preqs.: EB 600, ST 421, ST 502. 3(3-0) F.* The role and uses of statistical inference in economic research; the problem of spanning the gap from an economic model to its statistical counterpart; measurement problems and their solutions arising from the statistical model and the nature of the data; limitations and interpretation of results of economic measurement from statistical techniques.
T. Johnson

EB (ST) 652 Topics in Econometrics. *Preq.: EB (ST) 651. 3(3-0) S.* Survey of current literature on estimation and inference in simultaneous stochastic equations systems. Techniques for combining cross section and time series data including covariance, error correlated and error component models. Lag models and inference in dynamic systems. Production functions, productivity measurement and hypotheses about economic growth. Complete and incomplete prior information in regression analysis. Nonlinear estimation in economic models.
Gallant, Schrimper

EB 699 Research in Economics. *Preq.: Grad. standing. Credits Arranged.* Individual research in economics under staff supervision and direction.
Graduate Staff

Education

GRADUATE FACULTY

Professor C. J. Dolce, Dean

Professor J. B. Kirkland, Dean Emeritus

The following master's degree programs are offered by the School of Education:

- Adult and Community College Education
- Agricultural Education
- Curriculum and Instruction
- Educational Administration and Supervision
- Guidance and Personnel Services
- Industrial Arts Education
- Mathematics Education
- Occupational Education
- Psychology
- Science Education
- Special Education
- Vocational Industrial Education

Students accepted into any of the above education programs may seek either the Master of Science degree or the Master of Education degree; students admitted to the Department of Psychology seek the Master of Science degree. The Master of Science degree is research-oriented and is preparation for further graduate study. The Master of Education is a professional degree which allows for wider latitude in the choice of course work than is allowed by the Master of Science program.

The School of Education also offers certification programs at the intermediate (sixth-year) level in the following fields:

- Agricultural Education
- Curriculum and Instruction
- Educational Administration and Supervision
- School Counseling
- Mathematics Education
- Occupational Education
- School Psychology
- Science Education
- Special Education
- Vocational Industrial Education

The following doctoral programs are offered by the School of Education:

Adult and Community College Education	Ed.D.
Curriculum and Instruction	Ed.D.
Educational Administration and Supervision	Ed.D.

Guidance and Personnel Services	Ed.D.
Industrial Arts Education	Ed.D.
Mathematics Education	Ph.D.
Occupational Education*	Ed.D.
Psychology	Ph.D.
Science Education	Ph.D.

All doctoral programs require a minimum of one year of full-time resident study.

Graduate programs are planned by the student and his or her committee in terms of the student's educational and career objectives, experience and previous preparation.

Prior to consideration of an application for admission, the following must have been received: completed application form, an official copy of current (not more than three years old) Graduate Record Examination (GRE) scores, official transcripts of all undergraduate and graduate courses taken and at least three completed recommendation forms. In most programs an interview is required. Psychology also requires the GRE Advanced Test and the Miller Analogies Test. Individual programs may have additional requirements for admission. In order to maintain personalized, quality graduate programs, each program can enroll only a limited number of students regardless of the qualifications of the applicants.

The School of Education is housed in Poe Hall, a modern building with up-to-date research and instructional facilities, including:

Curriculum Materials Center—The Curriculum Materials Center, administered by the School of Education, is located in Poe Hall. The center maintains a collection of educational materials with particular emphasis on teaching methods, research, administration and psychology and includes films, filmstrips, slides, audiotapes, video cassettes and simulation games. A special collection of materials about third world countries is also maintained. Audiovisual equipment is available for previewing materials in the center. Microcomputers for teaching and research are a part of this facility. The center acquires textbooks adopted by the State Board of Education for secondary level subjects as well as other selected textbooks and reference materials. The mission of the center is to support programs in the School of Education, and the center's use by campus personnel outside of the School is limited.

Instructional Materials Production Center—Education, instruction and communication require the clear and effective presentation of content. The Instructional Materials Production Center (IMPC) aids this requirement through the design and production of instructional and informational materials in a range of formats. Although resources and personnel of the IMPC predominantly serve faculty, students and projects of the School of Education, increasing requests for materials from the University and beyond are met as possible on a contract basis.

The IMPC is directed by two instructional designers, faculty members of the School of Education which is unique in having a production facility in which two persons of such training function full time as designers, producers and consultants. Other personnel in the facility serve as teaching assistants, graphic designers or

*Students in agricultural education or industrial and technical education would seek the Ed.D. in occupational education.

are hired for the special needs of certain projects. Personnel work through the process of instructional design with those persons having a communicational need—faculty members, content specialists or project directors. Careful application of this process is necessary in order to determine what materials and strategies best serve the interrelated considerations of goals, objectives, content, users, audience, cost and available resources and is also necessary if final products are to be as lucid in design as in educational soundness. Formats in which materials are developed include: print, overhead transparencies, graphic imagery, displays and exhibits, signage, photography, slides, slide-tape presentations and in some cases videotape.

Office of Publications—This office prints and publishes instructional materials developed by faculty and students, as well as by public school teachers associated with various School programs.

Other Special Facilities—Poe Hall also houses an extensive variety of shops (metal, wood, ceramic, electrical and photography); a planetarium; counseling and testing centers; several laboratories for the study of behavior; an animal room; and a standardized test library.

Adult and Community College Education

Adult and community college education is a component of both the School of Education and the School of Agriculture and Life Sciences. For a listing of graduate faculty and departmental information, see adult and community college education.

Agricultural Education

GRADUATE FACULTY

Assistant Professor L. R. Jewell, *Coordinator*

Professor Emeritus: C. C. Scarborough; *Associate Professor:* C. D. Bryant;
Associate Professor Emeritus: T. R. Miller

The agricultural education program offers study leading to the Master of Science and the Master of Education degrees and to the intermediate (sixth-year) certificate. Both master's programs require a minimum of 36 semester hours which reflect the student's background and career expectations and which meet the approval of the student's advisory committee. Graduate programs are designed to meet the needs of individual students for further study and research as well as to prepare them for educational leadership roles in teaching, administration, supervision and research in agricultural education.

SELECTED ADVANCED UNDERGRADUATE COURSE

ED 407 Methods of Teaching Agricultural Mechanics. *Req.: BAE 201 or 211, 3(3-0) F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ED 554 Planning Programs in Agricultural Education. 3(3-0) F,S.

ED 565 Agricultural Occupations. 3(3-0) F,S.

ED 566 Occupational Experience in Agriculture. 3(3-0) F,S.

ED 568 Adult Education in Agriculture. 3(3-0) F,S.

ED 593 Special Problems in Agricultural Education. *Credits Arranged.* F,S.

FOR GRADUATES ONLY

ED 664 Supervision in Agricultural Education. 3(3-0) F,S.

ED 693 Advanced Problems in Agricultural Education. *Credits Arranged.* F,S.

ED 694 Seminar in Agricultural Education. 1(1-0) *Maximum 2 F.*

Counselor Education**GRADUATE FACULTY**

Professor N. A. Sprinthall, *Head*

Professors Emeriti: W. E. Hopke, C. G. Morehead; *Associate Professors:* E. R. Gerler, L. K. Jones, D. C. Locke, J. G. McVay, B. C. Talley Jr.

The department offers work leading to the Master of Science, Master of Education and Doctor of Education degrees as well as to the sixth-year certificate, with a major in the field of guidance and personnel services. Each of these degrees is designed to prepare individuals for guidance and personnel positions at various levels in elementary and secondary schools, junior and community colleges, trade and technical schools and institutes, institutions of higher education and community agencies. The student may specialize in one of several areas depending upon individual career goals.

It is desirable for an applicant to have had undergraduate or graduate course work in economics, education, psychology, sociology or social work as well as work experience in a human development context. Students accepted into the department are those who anticipate devoting full- or part-time to guidance and personnel work.

Admission requirements for the department are a minimum of a B average in the junior and senior years of undergraduate work; satisfactory scores on the aptitude section of the Graduate Record Examination or the Miller Analogies Test; three satisfactory letters of recommendation in regard to previous education and employment experiences, personal characteristics and emotional maturity.

For descriptions of the guidance and personnel courses listed below, see education courses.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

- ED 520 Introduction to Guidance and Counseling.** 3(3-0) *F,Sum.*
- ED 521 Internship in Guidance and Personnel Services.** *Credits Arranged. F,S.*
- ED 524 Information Processes and Group Guidance.** 3(3-0) *F,S,Sum.*
- ED 530 Theories and Techniques of Counseling.** 3(3-0) *F,S,Sum.*
- ED 533 Group Counseling.** 3(3-0) *S,Sum.*
- ED 534 Guidance in Elementary and Middle Schools.** 3(3-0) *F.*
- ED 535 Student Personnel Work in Higher Education.** 3(3-0) *F.*
- ED (PSY) 553 Community Service Agencies.** 3(3-0) *F.*
- ED 590 Special Problems in Guidance.** *Maximum 6 F,S.*

FOR GRADUATES ONLY

- ED 631 Vocational Development Theory.** 3(3-0) *F.*
- ED 633 Development and Coordination of School Guidance Programs.** 3(3-0) *S.*
- ED 636 Observation and Supervised Field Work.** 1-3 *F,S.*
- ED 640 Laboratory Experiences in Counseling.** 3(3-0) *F.*
- ED 641A Practicum in Counseling.** 2-6 *S.*
- ED 666 Supervision of Counseling.** 3(1-8) *F,S.*

Curriculum and Instruction**GRADUATE FACULTY**

Professor B. M. Parramore, Head

Associate Professors: C. L. Crossland, B. J. Fox, C. W. Harper Jr.; *Adjunct Associate Professor:* L. T. Sprinthall; *Associate Professor Emeritus:* P. J. Rust; *Assistant Professors:* J. F. Arnold, J. C. Hall, J. H. Hughes, R. J. Pritchard, M. D. Siedow, E. S. Vasu; *Adjunct Assistant Professors:* L. C. Aubrecht, D. D. Copeland, M. D. Durfee, N. D. LeVere; *Assistant Professor Emeritus:* K. A. McCutchen

The department offers work leading to the Master of Education, Master of Science and Doctor of Education degrees. A sixth-year program or certificate of advanced standing is also available. At least two years of successful teaching experience below the college level or other evidence of instructional skill is required of applicants seeking the supervisor's certificate. Each student's program is planned by a committee of three or more graduate faculty members and will reflect the ap-

plicant's undergraduate and graduate study, teaching experience and future professional plans. The purpose of the program is to prepare educators for leadership positions in the field of professional education. Applications are considered twice each year, in October and March.

The master's program is for those persons who wish to develop instructional skills and innovative methodology in program areas ranging from pre-school through post-secondary education, and who plan to qualify as instructional specialists and consultants. Program emphases include English and language arts education, social studies education, middle years education, reading education, supervision, instructional design with computers and curriculum development. A minimum of 36 hours is required in the master's program, which includes professional education, study in a teaching field and/or a minor outside the department. Candidates for the Master of Education degree must prepare and respond successfully to a written examination and an oral examination. Candidates for the Master of Science degree conduct an investigation culminating in a thesis. Those completing the master's program may qualify for a graduate teaching certificate or the supervisor's certificate.

The sixth-year program is for certification only and is planned individually to advance the student's study and experience as a professional. Doctoral programs are individually planned by the student's graduate committee. The programs include study in professional education, in academic disciplines related to teaching specialties, in instructional design, an internship and an emphasis on developing research competencies. The programs are for curriculum specialists and generalists, university instructors in professional education and instructional design specialists.

SELECTED ADVANCED UNDERGRADUATE COURSE

ED 483 An Introduction to Instructional Media. *Preq.: Advanced undergrad. standing. 3(3-0) F,S,Sum.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ED 502 The School Curriculum. *3(3-0) F.*

ED 507 Foundations of Middle Years Education. *3(3-0) F.*

ED 519 Early Childhood Education. *3(1-4) S,Sum.*

ED 542 Contemporary Approaches in the Teaching of Social Studies. *3(3-0) S.*

ED 544 The Teaching of Composition. *3(3-0) S.*

ED 545 Developmental Reading Instruction. *3(3-0) F.*

ED 546 Principles and Practices of Secondary School Reading Instruction. *3(3-0) F,S.*

ED 547 Analysis of Reading Abilities. *3(3-0) F.*

ED 548 Theory and Process in Reading and Language Arts. *3(3-0) F.*

ED 549 Reading for the Middle Years. 3(3-0) Alt. S.

ED 551 Principles and Practices of Supervision. 3(3-0) S.

ED 563 Effective Teaching. 3(3-0) F,S,Sum.

ED 576 Teaching/Learning Approaches for Emerging Adolescents. 3(3-0) S.

ED 583 Design and Evaluation of Instructional Materials. 3(3-0) S.

ED 598 Special Problems in Curriculum and Instruction. 1-6 F,S,Sum.

FOR GRADUATES ONLY

ED 602 Curriculum Theory and Development. 3(3-0) S.

ED 606 Remediation of Reading Disabilities. 3(3-0) S.

ED 641B Practicum in Reading. 1-6 S.

ED 641G Practicum in Middle Years Education. 3-6 F,S.

ED 687 Seminar in Curriculum and Instruction. 1-3 Alt. F.

Educational Administration and Supervision

GRADUATE FACULTY

Associate Professor B. G. Beezer, Coordinator

Professor: C. J. Dolce; Associate Professors: R. C. Serow, J. P. Sher; Visiting Associate Professors: W. B. Harvey, W. A. Jenkins; Adjunct Associate Professor: W. J. Brown; Assistant Professors: J. J. Davies, E. MacPhail-Wilcox; Visiting Assistant Professor: T. H. Stafford Jr.; Lecturer: R. T. Williams; Visiting Lecturer: W. E. Ballenger

The graduate programs in educational administration and supervision have a multidisciplinary emphasis which includes courses in economics, politics, psychology and sociology as well as in professional education. Programs are planned individually, based on an analysis of the student's career objectives and competencies. In addition to formal courses, planned non-credit experiences are designed to enhance the student's professional development.

The master's degree programs (M.S., M.Ed.), which require a minimum of 36 credit hours, are designed to prepare individuals for entry-level administrative and supervisory positions in public schools, colleges and other educational agencies. One semester of full-time residency is required in the Master of Science degree program. The master's program must be completed within four years from the semester of admission. An intermediate (sixth-year certificate) program is also available for public school personnel.

The doctoral degree program (Ed.D.), which requires extensive work in research and clinical practice (internship), is designed to prepare individuals for advanced

administrative and supervisory positions in public schools, human service agencies, and higher education. One academic year of full-time residency is required. The doctoral program must be completed within six years from the semester of admission.

In addition to admission requirements of the Graduate School, there are two additional requirements: a recent Graduate Record Examination score (both verbal and quantitative), and a narrative statement which describes in detail the applicant's career objectives and specific objectives for enrolling in the graduate program.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ED 513 Introduction to Issues and Techniques in Visual Impairments. *3(3-0) F.*

ED 514 Formative Ideas in American Education. *3(3-0) F.*

ED 515 Education and Social Diversity. *3(3-0) Alt. S.*

ED 517 Administrative Technology in Education. *3(3-0) F.*

ED 518 Introduction to Education Law. *3(3-0) S.*

ED 532 Introduction to Educational Inquiry. *3(3-0) F,S,Sum.*

ED 541B Practicum in Education Administration. *1-6 F,S.*

ED 550 Principles of Educational Administration. *3(3-0) F,S.*

ED 560 Teaching through the Arts. *3(3-0) S.*

ED 569 The Principalship. *3(3-0) S.*

ED 580 Evaluation Theory and Practice in Education. *3(3-0) F.*

ED 582 Teaching Braille and Communication Skills. *3(3-0) S.*

ED 586 Methods and Materials in Visual Impairments. *3(3-0) S.*

ED 589 Central Office Administration. *3(3-0) F.*

FOR GRADUATES ONLY

ED 614 Contemporary Educational Thought. *3(3-0) Alt. S.*

ED 616 History of Higher Education in the United States. *3(3-0) S.*

ED 618 School Law for the Administrator. *3(3-0) F.*

ED 620 Cases in Educational Administration. *3(3-0) S.*

ED 632 Applied Research Methods in Education. *3(1-4) S.*

ED 697 Problems of Research Design in Education. *1-3 F.*

Industrial and Technical Education

GRADUATE FACULTY

Associate Professor J. R. Clary, Acting Coordinator

Professors Emeriti: D. M. Hanson, J. T. Nerden; *Associate Professor Emeritus:* F. S. Smith; *Assistant Professor:* N. A. Foell; *Assistant Professor Emeritus,* T. C. Shore Jr.

The program in industrial and technical education provides graduate work leading to the degrees of Master of Science and Master of Education and to the intermediate (sixth-year) certificate in vocational industrial education. The rapid development of industrial and technical education in North Carolina and throughout the nation provides opportunities for teachers, supervisors and administrators who have earned advanced degrees.

The facilities at the University allow supporting courses at the graduate level in the related fields of computer science, economics and business, engineering, guidance and personnel services, mathematics, psychology, sociology and statistics. The prerequisite for graduate work in the programs in industrial and technical education is a proficiency in the undergraduate courses required for the bachelor's degree in industrial or technical education or a substantial equivalent.

SELECTED ADVANCED UNDERGRADUATE COURSES

ED 405 Industrial and Technical Education Shop and Laboratory Planning. *Preqs.: Sr. standing, six hours of drawing and design. 3(3-0) F.*

ED 421 Principles and Practices in Industrial Cooperative Training. *Preqs.: ED 327, 344, 305. 3(3-0) F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES*

ED 525 Trade Analysis and Course Construction. *3(3-0) F.*

ED 591 Special Problems in Industrial Education. *Maximum 6. F,S.*

FOR GRADUATES ONLY

ED 608 Supervision of Occupational Education. *3(3-0) F.*

ED 609 Planning and Organizing Industrial and Technical Education Programs. *3(3-0) F.*

ED 691 Seminar in Industrial Education. *1(1-0) S.*

**For other courses, see occupational education.*

Industrial Arts Education

GRADUATE FACULTY

Associate Professor T. B. Young, *Coordinator*

Professor Emeritus: D. W. Olson; *Associate Professors:* W. L. Cox Jr., R. E. Wenig;
Assistant Professor: R. E. Peterson

The industrial arts education program offers graduate work leading to the degrees of Master of Science, Master of Education and Doctor of Education. Graduate programs are designed for teachers who wish to develop their instructional competencies and for those who wish to be supervisors and administrators of industrial arts programs.

SELECTED ADVANCED UNDERGRADUATE COURSE

IA 480 Modern Industries. *Preq.: Jr. standing. 3(3-0) S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

IA 510 Design for Industrial Arts Teachers. *Preqs.: Six hours of drawing, IA 231 or equivalent. 3(2-2) Sum.* A study of new developments in the field of design with emphasis on the relationship of material and form in the selection and designing of industrial arts projects. Graduate Staff

ED 552 Industrial Arts in the Elementary School. *3(3-0) Sum.*

IA 560 New Developments in Industrial Arts Education. *Preqs.: Twelve hours of education and teaching experience. 3(3-0) F,S,Sum.* This course is a study of the new developments in industrial arts education. It is designed to assist teachers and administrators in developing new concepts and new content based on the changes in technology. Graduate Staff

IA 582 Visual Communications in Industrial Arts Education. *Preq.: Advanced standing in IAE or CI. 3(2-2) Alt. S.* Designed to enable teachers to understand key technical developments in the area of visual communications. Emphasis is upon developing pilot testing and evaluating a sequence of laboratory activities for school environment. Peterson

ED 588 Advanced Teaching Methods in Industrial Arts Education. *3(2-2) F,Sum.*

IA 590 Laboratory Problems in Industrial Arts. *Preqs.: Sr. standing, CI. Maximum 6. F,S,Sum.* Courses based on individual problems and designed to give advanced majors in industrial arts education the opportunity to broaden or intensify their knowledge and abilities through investigation and research in the various fields of industrial arts, such as metals, plastics, ceramics or electricity-electronics. Graduate Staff

IA 592 Special Problems in Industrial Arts. *Preq.: One term of student teaching or equivalent. Maximum 6. F,S,Sum.* The purpose of this course is to broaden the subject matter experience in the areas of industrial arts. Problems involving curriculum, investigation or research in one or more industrial arts areas will be required. Graduate Staff

IA 595 Industrial Arts Workshop. *Preq.: One or more years of teaching experience. 3(3-0) Sum.* A course for experienced teachers, administrators and supervisors of industrial arts. The primary purpose will be to develop sound principles and practices for initiating, conducting and evaluating programs in this field. Enrollees will pool their knowledge and practical experiences and will do intensive research work on individual and group problems.

Graduate Staff

FOR GRADUATES ONLY

ED 630 Philosophy of Industrial Arts. *2(2-0) F,S.*

ED 635 Administration and Supervision of Industrial Arts. *2(2-0) F,S.*

IA 645 Technology and Industrial Arts. *Preqs.: IA 560, ED 630. 3(3-0) F,S.* Technology: its nature, origins, advance. Impact of technological advance on man and culture. Technology as the material culture. Changing concepts of work, skill, occupations, discretionary time. Technology and its relation to industrial arts education.

Graduate Staff

ED 692 Seminar in Industrial Arts Education. *1(1-0) F,S.*

Mathematics and Science Education

GRADUATE FACULTY

Professor A. C. Howe, Head

Professors: N. D. Anderson, L. M. Clark, J. R. Kolb; Professor Emeritus: H. E. Speece; Associate Professors: W. M. Waters Jr., L. W. Watson, J. H. Wheatley; Associate Professor Emeritus: H. A. Shannon; Assistant Professor: L. V. Stiff

The Department of Mathematics and Science Education offers graduate work leading to the degrees of Master of Science, Master of Education and Doctor of Philosophy with majors in mathematics education or in science education and intermediate level certification in both fields. Each student's program is individually planned by a graduate committee and will reflect the student's undergraduate and graduate preparation, teaching experience and future professional plans. Students take courses in both professional education and in their teaching specialties. Areas of specialization include mathematics, biological sciences, earth science, chemistry and physics.

Doctoral students are required to have a reading knowledge of one modern foreign language. Additional communication skills may be required by the advisory committee. Independent reading and participation in seminars are an indispensable part of the doctoral program. The heart of the program is the dissertation, a document based on original research that makes a significant contribution to science education or mathematics education.

Applicants must meet the admissions requirements of the Graduate School and have departmental approval.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ED 511 Implications of Mathematical Content, Structure, and Processes for the Teaching of Mathematics in the Elementary School. 3(3-0) *F*.

ED 512 Teaching Mathematics in Elementary and Junior High School. 3(3-0) *S,Sum*.

ED 570 Foundations of Mathematics Education. 3(3-0) *Sum*.

ED 575 Foundations of Science Education. 3(3-0) *S,Sum*.

ED 577 Improving Classroom Instruction in Science. 3(3-0) *S,Sum*.

ED 592 Special Problems in Mathematics Teaching. 1-3 *Sum*.

ED 594 Special Problems in Science Teaching. 1-3 *Sum*.

FOR GRADUATES ONLY

ED 603 Teaching Mathematics and Science in Higher Education. 3(3-0) *F*.

ED 604 Curriculum Development and Evaluation in Science and Mathematics. 3(3-0) *S*.

ED 605 Education and Supervision of Teachers of Mathematics and Science. 3(3-0) *S*.

ED 641D Practicum in Science and Mathematics Education. 1-6 *F,S*.

ED 690 Seminar in Mathematics Education. 2(2-0) *F,S*.

ED 695 Seminar in Science Education. 2(2-0) *F,S*.

Occupational Education**GRADUATE FACULTY**

Associate Professor J. R. Clary, Head

Professor: J. K. Coster; Professors Emeriti: D. M. Hanson, J. T. Nerden, C. C. Scarborough; Associate Professors: C. D. Bryant, W. L. Cox Jr., M. J. Iverson, R. E. Wenig, T. B. Young; Associate Professors Emeriti: T. R. Miller, F. S. Smith; Assistant Professors: J. A. Davis—Coordinator of Health Occupations, L. S. Dillon, N. A. Foell, L. R. Jewell—Graduate Administrator, R. E. Peterson, W. J. Vander Wall; Visiting Assistant Professor: M. M. Turnbull; Adjunct Assistant Professors: C. E. Belcher, B. M. Patterson; Assistant Professor Emeritus: T. C. Shore Jr.

The Department of Occupational Education includes programs leading to advanced degrees in the program areas of agricultural education, health occupations education, industrial and technical education, and industrial arts education. For descriptions of the advanced degree programs in these areas, see earlier sections in education. In addition, the department offers advanced degree programs in oc-

cupational education and courses leading to certification in the teaching of Introduction to Vocations.

This section of the catalog describes the advanced programs in occupational education *per se*; that is, programs in which the major is occupational education. The department offers leadership development programs in occupational education for the Master of Education and Master of Science degrees, the Intermediate (Sixth-Year) Program, and Doctor of Education degree.

The master's programs are designed to prepare persons for entry-level administrative and supervisory positions in occupational education. However, students may prepare for other careers, such as master teachers of Introduction to Vocations or career exploration programs.

The master's programs require a minimum of 36 semester hours of graduate work, including 27 hours in the major. Additional hours will be specified by the student's advisory committee for those who do not have a baccalaureate degree in an occupational education field. Students who elect the Master of Science substitute the thesis for part of the course load.

The Intermediate (Sixth-Year) Program requires a minimum of 60 semester hours of graduate work, including 48 hours in the major.

The primary purpose of the doctoral program is to prepare persons for advanced positions in occupational education. Students may elect to prepare for such positions as administrator, research specialist, curriculum development specialist or teacher educator in occupational education. A minimum number of 90 semester graduate work beyond the baccalaureate degree is specified for the doctoral program. Emphasis is placed on developing competencies, and students may be advised to supplement their course work.

Applicants to the graduate level programs must take the Graduate Record Examination or the Miller Analogies Test and submit a resume of work experience with a statement of career goals. Application processes must be completed within six months of the date the application is received.

All doctoral programs require a minimum of one year of full-time resident status and programs must be completed within six years from the beginning of the semester in which the student is initially enrolled in the doctoral classification. Other department policies should be requested from the graduate administrator.

SELECTED ADVANCED UNDERGRADUATE COURSE

ED 457 Organization and Management of Youth Club Activities. *Preq.: Jr. standing. 3(3-0) F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ED 504 Principles and Practices of Introduction to Vocations. *3(3-0) F,S,Sum.*

ED 516 Community Occupational Surveys. *2(2-0) S.*

ED 522 Career Exploration. *3(3-0) F,S,Sum.*

ED 527 Philosophy of Occupational Education. *3(3-0) F,S.*

ED 528 Cooperative Occupational Education. *3(3-0) F,S.*

ED 529 Curriculum Materials Development. 3(3-0) F,S.

ED 541A Practicum in Occupational Education. 1-6 F,S.

FOR GRADUATES ONLY

ED 608 Supervision of Occupational Education. 3(3-0) Alt. F.

ED 609 Planning and Organizing Industrial and Technical Education Programs. 3(3-0) Alt. F.

ED 610 Administration of Occupational Education. 3(3-0) Alt. S.

ED 611 Laws, Regulations and Policies Affecting Occupational Education. 3(3-0) S.

ED 612 Finance, Accounting, and Management of Occupational Education Programs. 3(3-0) Alt. S.

ED 688 Research Application in Occupational Education. 3(3-0) F,S.

ED 689 Evaluation in Occupational Education. 3(3-0) F,S.

Health Occupations Education Program Area—The master's degree level program track in health occupations teacher education has been established in response to an increasing need for accountability in professional education and for qualified educators in the health fields. The program is designed to provide a broad comprehension of the health care delivery system and the education of future providers of service and to develop competency in curriculum and instruction planning and implementation. Students desiring to move into administrative and supervisory roles are encouraged to design a plan of study consistent with their personal goals. Students must hold credentials in one of the health disciplines and have knowledge of the health care system.

Students will be encouraged to participate in the interinstitutional cooperative program that exists between the graduate school of North Carolina State University, Duke University and the University of North Carolina at Chapel Hill which makes available a vast array of offerings in the health field from which to select courses.

SELECTED ADVANCED UNDERGRADUATE COURSE

ED 433 Health Occupations Specialty Practicum. *Preq.: Current credential in a recognized health discipline.* 6 Arranged. F,S.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ED 555 Issues and Trends in Education for the Allied Health Professions. 3(3-0) Alt. yrs.

ED 581 Curriculum and Instruction in the Allied Health Professions. 3(3-0) Alt. yrs.

ED 584 Health Care Delivery Systems and Environments. 3(3-0) Alt. yrs.

FOR GRADUATES ONLY

ED 615 Special Topics in Health Occupations Education. 3-5 F,S,Sum.

ED 641J Practicum in Health Occupations. 3(3-0) Alt. yrs.

Psychology

For a listing of departmental faculty and courses, see psychology.

Special Education

The master's degree programs, M.Ed. and M.S., are administered by the Department of Curriculum and Instruction. The primary objective is to educate teachers of students who require specialized instructional skills and techniques, *e.g.*, mentally retarded, learning disabled, behavior disordered and sensory impaired students such as the visually handicapped. The student's program is individually planned and places emphasis upon the fields of psychology and education. Candidates for the Master of Education degree must pass written and oral examinations. A thesis is required for the Master of Science degree. Applications are considered in October and March for enrollment the following summer or fall.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

- ED 506 Education of Exceptional Children. 3(3-0) F,S,Sum.
- ED 508 Education of Severely Handicapped. 3(3-0) F.
- ED 509 Methods and Materials—Teaching Retarded Children. 3(3-0) S.
- ED 523 Orientation and Mobility of the Visually Impaired. 3(3-0) F.
- ED (PSY) 531 Mental Retardation. 3(3-0) F.
- ED 536 Structure and Function of the Eye and Use of Low Vision. 3(3-0) F.
- ED 540 Career/Vocational Education for the Handicapped. 3(3-0) S.
- ED 556 Learning Disabilities. 3(3-0) F.
- ED 557 Methods and Materials in Learning Disabilities. 3(3-0) S.
- ED 558 Resource Teaching in Special Education. 3(3-0) F.
- ED 561 Educational Diagnosis and Prescription for Exceptional Children. 3(3-0) S.
- ED 562 Communication Disorders in the Classroom. 3(3-0) Alt. S.
- ED 564 Classroom Management in Special Education. 3(3-0) S.
- ED 571 Introduction to the Gifted Individual. 3(3-0) F.
- ED 572 Methods for Teaching the Gifted. 3(3-0) S.
- ED 573 Behavior Disorders. 3(3-0) F.
- ED 574 Methods and Materials: Behavior Disorders. 3(3-0) S.

FOR GRADUATES ONLY

ED 641C Practicum in Special Education. 1-6 F,S.

Education Courses**FOR GRADUATES AND ADVANCED UNDERGRADUATES**

ED 500 Community College and Two-year Postsecondary Education. *Preq.: Grad. standing or PBS status. 3(3-0) F,S.* Comprehensive community colleges and technical institutes and the state systems of which they are a part: underlying concepts, educational needs they are designed to serve, role in meeting these needs, historical development, issues in the establishment and operation of state systems and individual institutions, unresolved issues and emerging trends.
Graduate Staff

ED 502 The School Curriculum. *Preq.: 12 semester hours ED and PSY or CI. 3(3-0) F.* A study of the origin, development, and current status of the elementary and secondary school curriculum and an evaluation of the trends and issues likely to influence the curriculum in the future.
Parramore

ED 503 The Programming Process in Adult and Community College Education. *Preqs.: ED 501, CI. 3(3-0) F,S.* The principles and processes involved in programming, including basic theories and concepts supporting the programming process. Attention will be given to the general framework in which programming is done, the organization needed and the program roles of both professional and lay leaders.
Graduate Staff

ED 504 Principles and Practices of Introduction to Vocations. *Preq.: 12 hours ED or CI. 3(3-0) F,S,Sum.* This course is designed for teachers in the public schools of North Carolina who teach "Introduction to Vocations." The course emphasizes the place of the introduction to vocations program in the overall school curriculum, special methods of instruction, use of teaching aids and use of student evaluation instruments. An overview is also presented in the areas of community organization, job markets, group procedures, occupational and educational information and the changing occupational structure in our society.
Clary, Dillon

ED 505 Public Area Schools. *Preq.: Grad. standing or PBS status. 3(3-0) F.* Junior and community colleges, technical institutes, vocational schools and branches of universities: their development, status and prospects, policy and policy-making, clientele, purposes, evaluation programs, personnel, organization administration, financing, facilities, research and development functions.
Graduate Staff

ED 506 Education of Exceptional Children. *Preq.: 9 hours of ED or PSY. 3(3-0) F,S,Sum.* An introduction to the field of Special Education. The course focuses on the historical overview, definitions and terminology in the basic areas of exceptionality; etiological factors in exceptionality; developmental and learning characteristics of each area of exceptionality; and educational settings and strategies employed in special education. A review is given of current educational laws and policies affecting special education.
Graduate Staff

ED 507 Foundations of Middle Years Education. *Preq.: 6 hours of ED and PSY. 3(3-0) F,S.* Five major aspects of middle years education are examined: (a) the history and purposes of middle/junior high school, (b) pre- and early adolescent needs, interests and abilities, (c) curriculum design and content, (d) teaching methods and (e) school organization. Both theoretical understandings and effective classroom strategies will be emphasized. Arnold

ED 508 Education of Severely Handicapped. *Preq.: ED 531 or ED 574 or CI. 3(3-0) F.* A study of severe and profound mental retardation and autism, including assessment procedures, educational and social/vocational programs, instructional strategies and evaluation. Legal and ethical issues involved in working with the severely handicapped are examined. Hasselbring, Hughes

ED 509 Methods and Materials—Teaching Retarded Children. *Preqs.: ED 506 and ED 531 or CI. 3(3-0) S.* A study of the methods and materials related to teaching mentally retarded school age children. Course will include the study of the learning and behavioral characteristics and educational programs for the mentally retarded in the areas of motor, communications, social, academic and vocational development. Crossland, Hasselbring

ED 510 Adult Education: History, Philosophy, Contemporary Nature. *Preqs.: Advanced undergrad., CI. 3(3-0) F,S.* A study of the historical and philosophical foundations of adult education from ancient times to the present, giving attention to key figures, issues, institutions, movements and programs, including consideration of the relationship between adult education's historical development and prevailing intellectual, social, economic and political conditions. Consideration of adult education's contemporary nature, present-day schools of thought on its objectives and trends. Carter

ED 511 Implications of Mathematical Content, Structure, and Processes for the Teaching of Mathematics in the Elementary School. *Preq.: Bachelor's degree in elementary education or CI. 3(3-0) F.* Designed for teachers and supervisors of mathematics in the elementary school. Special emphasis on implications of mathematical content, structure, and processes in teaching arithmetic and geometry in elementary school. Watson

ED 512 Teaching Mathematics in Elementary and Junior High School. *Preq.: ED 471 or equivalent. 3(3-0) S,Sum.* Comprehensive study of teaching mathematics in elementary and junior high schools. Major emphasis on building skills in teaching arithmetic, elementary algebra and intuitive geometry. Thorough search of the literature relative to the mathematics curricula will be conducted, designing and sequencing of learning activities, teaching mathematical concepts and relationships, building skill in computation, reading mathematics, problem solving and measurement will be covered. Watson

ED 513 Introduction to Issues and Techniques in Visual Impairments. *Preq.: ED 506. 3(3-0) F.* Addresses historical developments, trends, issues and basic skill techniques for the visually impaired. Includes societal perceptions, societal integration, effects of a visual impairment on development, psychosocial adjustment and Braille transcription skills. Zambone

ED 514 Formative Ideas in American Education. *Preq.: Six hours ED or PSY or CI. 3(3-0) F.* A consideration of the theory and practice of American education as an extension of the philosophical climate of opinion of different intellectual ages and how the present status of our educational system is grounded in the thought of the past. Beezer

ED 515 Education and Social Diversity. *Preq.: Six hours ED, PSY and/or social science. 3(3-0) Alt. S.* An overview of the role of education within a culturally diverse society. Major attention is directed to racial, ethnic, socioeconomic and regional subpopulations. Among the issues to be discussed are the subcultural influences on public school performances, equality of educational opportunity, social stratification and mobility and the impact of schooling on intergroup relations. Serow

ED 516 Community Occupational Surveys. *Preq.: Grad. standing or PBS status. 2(2-0) S.* Methods in organizing and conducting local surveys and evaluation of findings in planning a program of occupational education. Shore

ED 517 Administrative Technology in Education. *Preqs.: ED 550 or equivalent and ED 532 or equivalent or CI. 3(3-0) F.* Designed to provide professional educators and human service planners with planning and management techniques using current information and communication technologies. Students use both equipment and procedural applications for financial planning, data base management, case management, scheduling, modeling and other management techniques.
Ballenger, MacPhail-Wilcox

ED 518 Introduction to Education Law. *Preq.: Six hours graduate credit. 3(3-0) S.* A study of constitutional, statutory and case law as it relates to educational settings, particularly in the areas of students, teachers and liability. Includes all educational levels with particular reference to North Carolina and federal law.
Beezer

ED 519 Early Childhood Education. *Preq.: PSY 475 or PSY 576. 3(1-4) S,Sum.* Planning, selecting and using human resources, activities, materials and facilities in the education of young children. Student observation, participation and evaluation of educational experiences for the developmental level of individual children for an optimum learning environment. A synthesis of the student's knowledge of human development, learning theory and research findings as related to classroom application.
Graduate Staff

ED 520 Introduction to Guidance and Counseling. *Preq.: Six hours in ED or PSY. 3(3-0) F,S,Sum.* An introduction to the philosophies, theories, principles and issues of guidance and counseling services, with major emphasis on guidance at the secondary school level.
Graduate Staff

ED 521 Internship in Guidance and Personnel Services. *Preqs.: Eighteen hours in department and CI. Credits Arranged. F,S.* A continuous full-time internship of at least one-half semester. Framework of school and community. Work with students, teachers, administrators, guidance and pupil personnel workers, parents and resource personnel in the community. Supervision of intern by guidance personnel in school as well as by course instructors.
Graduate Staff

ED 522 Career Exploration. *Preq.: 12 hours ED or CI. 3(3-0) F,S,Sum.* This course is designed for teachers in the public schools of North Carolina who teach in "Career Exploration" programs. The course emphasizes the philosophy of career exploration, theories supporting career exploration, the place of exploration programs in the overall school curriculum, correlation of occupational information in academic subjects, sources of occupational information and its use and approaches to teaching in a career exploration program.
Clary, Dillon

ED 523 Orientation and Mobility of the Visually Impaired. *Preq.: CI. 3(3-0) F.* The sensory processes and sensory cues on which independent mobility depends for the visually impaired person. Various techniques and modes of travel considered. Emphasis given to instruction and background which will enable person not teaching orientation mobility as a skill to reinforce the learning that takes place in other situations.
Graduate Staff

ED 524 Information Processes and Group Guidance. *Preq.: Six hours of ED or PSY. 3(3-0) F,S,Sum.* The collection, classification and use of occupational, educational and personal-social information in schools, post-secondary institutions and agencies. The course is also designed to help teachers and counselors learn about group guidance activities and to learn how to plan and organize the information service as well as specific guidance activities in groups.
Gerler

ED 525 Trade Analysis and Course Construction. *Preq.: 12 hours ED or CI. 3(3-0) F.* Principles and practices in analyzing occupations for the purpose of determining teaching content. Practice in the principles underlying industrial course organization based on occupational analysis covering instruction skills and technology and including course outlines, job sequences, the development of industrial materials and instructional schedules.
Shore

ED 526 Teaching in College. *3(3-0) Sum.* This course focuses on the development of competencies to perform the fundamental tasks of a college teacher as well as consideration of more long-range tasks such as course development and the university responsibilities of a professor. In addition to attending lectures and other types of presentations, students will make video tapes of their teaching, develop tests, design an introductory course in their teaching field and discuss current issues that relate to university and college teaching.

Graduate Staff

ED 527 Philosophy of Occupational Education. *Preq.: 12 hours ED or CI. 3(3-0) F,S.* An historical and philosophical investigation into the social and economic aspects of occupational education; an overview of the broad field of occupational education for youth and adults, with emphasis upon the trends and problems connected with the conduct of occupational education under federal and state guidance. An overview study of federal and state legislation pertaining to occupational education.

Graduate Staff

ED 528 Cooperative Occupational Education. *Preq.: Grad. standing or PBS status. 3(3-0) F,S.* Designed for individuals preparing to be directors, administrators or supervisors of occupational education programs at the local, state and/or national levels. Emphasis on organization and operation of cooperative occupational education programs. Covers the entire field of cooperative occupational education on secondary, postsecondary and adult levels with references to accepted essentials of cooperative education so details of planning, organization, establishment and operation of cooperative occupational programs will be practical and meaningful. Student visitations to existing quality programs in cooperative occupational education to study on-site conditions in specialized areas.

Dillon

ED 529 Curriculum Materials Development. *Preqs.: Grad. standing and ED 527 or ED 630 or equivalent. 3(3-0) S.* Selection and organization of curricula and instructional materials in occupational education.

Dillon

ED 530 Theories and Techniques of Counseling. *Preq.: Six hours of ED or PSY; Coreq.: ED 520 or equivalent. 3(3-0) F,S,Sum.* A combination of the study of theory and philosophy in counseling with techniques of counseling. Topics to be examined include behavioral approaches, psychoanalytic approaches, client-centered counseling, existential counseling and relationship models, and their relation to counseling. For each theory, the techniques are related to the theoretical concepts and principles.

Locke

ED (PSY) 531 Mental Retardation. *Preq.: ED 506 or CI. 3(3-0) F.* The definitions, classifications, diagnostic and treatment procedures for mental retardation are examined from medical, sociological and educational points of view. Categories of retardation examined include mild, moderate, severe and profound.

Hasselbring

ED 532 Introduction to Educational Inquiry. *Preq.: Grad. standing or PBS status. 3(3-0) F,S,Sum.* A survey of basic concepts and methods of educational inquiry. Emphasis is on the logic underlying various approaches to problem definition and solution and on the tools of the investigator, as well as on sources and interpretation of research information related to the student's particular area of study.

Davies

ED 533 Group Counseling. *Preq.: ED 530. 3(3-0) S,Sum.* A study of the theory and principles of effective group work and the skills necessary for using specific counseling techniques, for the planning and organization of group counseling activities in the elementary school, secondary school or other institutions. Supervised experience provides, to a limited extent, practice in the use of various techniques of group leadership in the area of interest for each student.

Locke

ED 534 Guidance in Elementary and Middle Schools. *Preq.: Six hours in ED or PSY. 3(3-0) F.* Introduces teachers, counselors and school administrators to the theory, practice and organization of elementary and middle school guidance programs.

Gerler

ED 535 Student Personnel Work in Higher Education. *Preq.: Nine hours PSY or CI. 3(3-0) F.* Examines practices in various areas of student personnel work. Studies both structure and function of student personnel programs in higher education. McVay

ED 536 Structure and Function of the Eye and Use of Low Vision. *Preq.: CI. 3(3-0) F.* Special institute for participants to spend minimum of 45 hours in class and class related activities. Medical and educational consultants discuss structure and function of the eye, eye anomalies affecting children with low vision, methods of teaching children to use minimal vision effectively. Graduate Staff

ED 537 The Extension and Public Service Function in Higher Education. *Preq.: ED 510. 3(3-0) S.* An examination of the background, history, philosophy and contemporary nature of the extension and public service function of institutions of higher education in the United States. Emphasis is placed on the adult education role of public and private universities and colleges. Specific focus is on: general extension, industrial extension, engineering extension, cooperative extension and continuing education. Graduate Staff

ED 538 Instructional Strategies in Adult and Community College Education. *Preq.: Grad. standing or PBS status. 3(3-0) F.* This course examines forms of instruction appropriate for the teaching of adults. Special emphasis will be placed upon methods which maximally involve the adult learner. The study of concepts, theories and principles relevant to the selection, utilization and evaluation of instructional strategies will focus on the integration of theory into practice. Through participation in classroom exercises, the student will develop proficiency in using teaching techniques which are applicable in adult and community college education. Graduate Staff

ED 539 Educational Gerontology. *Preq.: Six hours in ED, SOC or PSY. 3(3-0) F.* A broad overview of factors associated with the education of older adults. Various sociological, physiological, psychological and economic aspects of aging are explored in terms of their educational implications. Attention is given to knowledge and skills required for the development of educational programs for the aging population. Graduate Staff

ED 540 Career/Vocational Education for the Handicapped. *Preqs.: ED 506 and ED 527 or CI. 3(3-0) S.* Relevant definitions and current legislation and policies are reviewed. Appropriate curriculum, methods and materials are studied. Topic areas include program development, vocational evaluation, job placement and support services for the handicapped. Clary, Hughes

ED 541A Practicum in Occupational Education. *Preq.: Grad. standing or PBS status. 1-6 F,S.* Under a faculty-supervised practicum in an educational, industrial or governmental setting, the student participates in and analyzes activities associated with the planning, implementation and evaluation of instructional programs or services in vocational education. A unique plan is developed by the student and approved by the supervisor. Clary

ED 541B Practicum in Education Administration. *Preqs.: ED 550 and CI. 1-6 F,S.* Supervised experience in an appropriate educational setting to enable the student to gain practice in applying concepts, principles and theories of education administration. Graduate Staff

ED 542 Contemporary Approaches in the Teaching of Social Studies. *Preqs.: Advanced undergrad. or grad. standing; must have completed student teaching. 3(3-0) S.* An analysis of the principles, strategies and application of new teaching approaches. Preinstructional activities, methods that focus on the individual and group and instructional developments and trends are explored. Harper

ED 543 Adulthood and Learning: The Later Years. *Preq.: ED 539 or CI. 3(3-0) Alt. S. A* study of basic sensory, attitudinal, intellectual and emotional changes that occur in-

dividuals during the process of growing old and the implications of these changes for developing, implementing and evaluating educational programs for and with older adults.

Glass

ED 544 The Teaching of Composition. *Preqs.: 9 hours of ED, PSY and/or ENG. 3(3-0) S.* For classroom teachers. Offers practical field-tested ideas to help students improve as writers by focusing on composition as a process as well as a product. Activities for teaching prewriting, composing, revising, proofreading, grammar and evaluating will be practiced, with suggestions for individual group learning. Research related to effective composition teaching will be reviewed.

Pritchard

ED 545 Developmental Reading Instruction. *Preqs.: Twelve hours of ED or PSY and CI. 3(3-0) F.* A study of current methods and materials for the teaching of developmental and remedial reading, with emphasis on planning and implementing instructional programs for children with reading competencies from prereading through grade six.

Fox

ED 546 Principles and Practices of Secondary School Reading Instruction. *Preqs.: Twelve hours in ED or PSY and CI. 3(3-0) F,S.* A study of principles and practices of teaching reading at the secondary school level, including reading instruction in the content areas.

Siedow

ED 547 Analysis of Reading Abilities. *Preqs.: ED 545 or ED 546 and CI. 3(3-0) F.* A study of tests and techniques in determining specific abilities; a study of reading retardation and factors underlying reading difficulties.

Fox

ED 548 Theory and Process in Reading and Language Arts. *Preqs.: Twelve hours in ED or PSY and CI. 3(3-0) F.* An investigation of theoretical models and processes in reading and language arts with emphasis on the translation of research findings to instructional practice.

Fox, Siedow

ED 549 Reading for the Middle Years. *Preqs.: Twelve hours in ED or PSY. 3(30) Alt. S.* An investigation of issues related to middle years reading development, transition of reading skills to content areas and aspects of middle years reading program organization.

Fox, Siedow

ED 550 Principles of Educational Administration. *Preqs.: Grad. standing, CI. 3(3-0) F.* This course is designed as an introductory course in educational administration. Emphasizing basic principles of administration, the course will draw upon administrative theory, business and public administration models as well as theoretical constructs from various disciplines.

MacPhail-Wilcox

ED 551 Principles and Practices of Supervision. *Preqs.: 6 semester hours ED/PSY graduate study and CI. 3(3-0) S.* Designed to provide the educational leader with an understanding of the nature of instructional supervision, skills needed in supervising educational programs and an analysis of promising practices for improving programs. Opportunity is provided for application of principles of supervision to one or more practical problems.

Parramore

ED 552 Industrial Arts in the Elementary School. *Preqs.: Twelve hours ED, CI. 3(3-0) Sum.* This course is organized to help elementary teachers and principals understand how tools, materials and industrial processes may be used to vitalize and supplement the elementary school child's experiences. Practical children's projects along with the building of classroom equipment.

Graduate Staff

ED (PSY) 553 Community Service Agencies. *Preqs.: Six semester hours of ED, PSY or SOC or CI. 3(3-0). F.* An introduction to the issues, functions, and scope of the work being

done in various human service agency programs; an overview of helping approaches with selected client populations; related professional concerns will be examined.

Graduate Staff

ED 554 Planning Programs in Agricultural Education. *Preq.: Grad. standing or PBS status. 3(3-0) F, S.* Consideration of the need for planning programs in education; objectives and evaluation of community programs; use of advisory group; organization and use of facilities.

Graduate Staff

ED 555 Issues and Trends in Education for the Allied Health Professions. *Preq.: Grad. standing or CI. 3(3-0) Alt. yrs.* An analysis of educational and social factors influencing change in health professions education. Emphasis will be on problems of student selection and program articulation and the implications for health occupations education and health services of recent legislation regarding the handicapped.

Nunley

ED 556 Learning Disabilities. *Preq.: ED 506 or CI. 3(3-0) F.* A study of the field of learning disabilities, including definitions, prevalence, etiology, characteristics and current educational trends for educating learning disabled students.

Crossland

ED 557 Methods and Materials in Learning Disabilities. *Preq.: ED 556 or CI. 3(3-0) S.* A study of the current methods and materials for the teaching of learning disabled students in the elementary and/or secondary schools, including curriculum and instructional techniques. Course will focus on examination of commercial materials and the development of teacher-made materials for use with the learning disabled student.

Crossland

ED 558 Resource Teaching in Special Education. *Preq.: ED 506 or CI. 3(3-0) F.* A study of resource teaching in the area of special education, with emphasis on resource teaching with the learning disabled and mentally retarded. Course will focus on types of resource programs, how to establish and maintain a program, selection of students, curriculum and materials.

Graduate Staff

ED 559 The Adult Learner. *Preq.: Six hours in ED. 3(3-0) S.* Principles involved in adult education programs including theories and concepts undergirding and requisite to these programs. Emphasis will be given to interrelationship of the nature of adult learning, the nature of the subject matter and the setting in which learning occurs. The applicability of relevant principles and pertinent research findings to adult learning will be thoroughly treated.

Graduate Staff

ED 560 Teaching through the Arts. *Preq.: 6 hrs. in ED and/or PSY. 3(3-0) Alt. F.* Examines the role of the arts in the teaching/learning process, emphasizing ways classroom teachers can use the arts to foster students' personal growth, creativity and academic achievement. Develops teaching skills through explorations in graphic arts, sculpture, dance/movement, drama, film, creative writing and poetry.

Graduate Staff

ED 561 Educational Diagnosis and Prescription for Exceptional Children. *Preq.: ED 506 or CI. 3(3-0) S.* A study of the concept of educational diagnosis of exceptional students, including an examination of educational diagnostic procedures in current use in special education. Course will focus on the development of informal diagnostic techniques and procedures for adapting curriculum and instruction for the exceptional learner.

Graduate Staff

ED 562 Communication Disorders in the Classroom. *Preq.: ED 506 or CI. 3(3-0) Alt. S.* A study of communication disorders which occur in the school age population, including types of disorders, prevalence, etiology, characteristics and corrective therapy. Course will focus on communication disorders among exceptional students and the classroom teacher's role in working with communication disorders.

Crossland

ED 563 Effective Teaching. *Preq.: Twelve hours ED including student teaching. 3(3-0) F,S,Sum.* Analysis of the teaching-learning process; assumptions that underlie course approaches; identifying problems of importance; problem solution for effective learning; evaluation of teaching and learning; making specific plans for effective teaching.

Graduate Staff

ED 564 Classroom Management in Special Education. *Preq.: ED 506 or CI. 3(3-0) S.* A study of the concepts and procedures involved in the design and implementation of techniques for managing exceptional students in a classroom setting. Course will focus on methods for increasing and maintaining appropriate classroom behaviors in exceptional learners.

Graduate Staff

ED 565 Agricultural Occupations. *Preq.: 12 hours ED or CI. 3(3-0) F,S.* The theory of education and work is related to the expanding field of agricultural occupations. Career development in agricultural occupations is associated with curriculum development needs. Occupational experience in agriculture is seen in relation to the curriculum and the placement in agricultural occupations.

Graduate Staff

ED 566 Occupational Experience in Agriculture. *Preq.: Grad. standing or PBS status. 3(3-0) F,S.* A major and critical element in all programs of vocational education is the provision for appropriate student learning experiences in a real and simulated employment environment. Due to recent developments in education and agriculture, new and expanded concepts of occupational experience have been devised. Current research substantiates the need and desire of teachers of agriculture for assistance in implementing the new concepts. The course is designed not only to provide this aid but to develop a depth of understanding of the theoretical foundations underlying the new developments in occupational experiences to stimulate individual growth and creativity in implementing further developments.

Graduate Staff

ED 567 Concepts and Strategies of Understanding, Motivating and Teaching Disadvantaged Adults. *Preqs.: Advanced undergrad., CI. 3(3-0) S,Sum.* Designed to help adult educators acquire a comprehensive understanding of the educational, psychological, social, cultural and economic problems of the culturally deprived segments of society. In-depth explorations of the theoretical basis for understanding, motivating and teaching disadvantaged adults will be interwoven with practical application of these bases to specific educational opportunities with the disadvantaged adult learner.

Graduate Staff

ED 568 Adult Education in Agriculture. *Preq.: Grad. standing or PBS status. 3(3-0) F,S.* Designed to meet the needs of leaders in adult education. Opportunity to study some of the basic problems and values in working with adult groups. Attention will be given to the problem of fitting the educational program for adults into the public school program and other educational programs as well as to the methods of teaching adults.

Graduate Staff

ED 569 The Principalship. *Preq.: ED 550 or CI. 3(3-0) S.* A survey course covering the major responsibilities and tasks of a school principal, e.g., curriculum and instructional leadership, teacher recruitment and selection, fiscal record keeping, pupil schedules, plant management. Students will combine findings from their readings with present practices to develop workable solutions to managerial and instructional problems.

MacPhail-Wilcox

ED 570 Foundations of Mathematics Education. *Preq.: ED 471 or equivalent. 3(3-0) Sum.* A course on the current status of mathematics education with special emphasis on the critical study of current practices in mathematics instruction from elementary school through college.

Kolb

ED 571 Introduction to the Gifted Individual. *Preq.: ED 506 or CI. 3(3-0) F.* A study of theories and concepts of giftedness and procedures in identifying the gifted, with a consideration of factors influencing giftedness and ways it may be fostered.

Aubrecht

ED 572 Methods for Teaching the Gifted. *Preq.: ED 571 or CI. 3(3-0) S.* A study of major approaches used in the education of the gifted, including an opportunity to develop a unit plan based upon one of these approaches. Aubrecht

ED 573 Behavior Disorders. *Preq.: ED 506 or CI. 3(3-0) F.* A study of definitions, etiology, characteristics, philosophies and approaches to educational programming for children and youth with behavior disorders, including the emotionally handicapped, autistic and socially maladjusted. Hughes

ED 574 Methods and Materials: Behavior Disorders. *Preq.: ED 573 or CI. 3(3-0) S.* A study of curriculum materials, instructional strategies and behavior management techniques related to teaching behaviorally disordered children and youth, including individualized instruction, group process, organization and evaluation of classroom programs, parent involvement, community resources and teachers' personal and professional growth and development. Hughes

ED 575 Foundations of Science Education. *Preq.: ED 475 or equivalent. 3(3-0) S, Sum.* Philosophical, historical, sociological, political and economic factors affecting science education in the schools of the United States will be analyzed. The implications of various learning theories for science education will be examined along with models for curriculum development and program planning. Current trends, issues and problems in science education will be evaluated in terms of multiple positions. Anderson

ED 576 Teaching/Learning Approaches for Emerging Adolescents. *Preqs.: ED 507 or equivalent; grad standing and CI. 3(3-0) S.* Exploration of teaching/learning approaches appropriate to emerging adolescents. Topics include learning styles; interdisciplinary inquiry; community-based curriculum; simulations and games; learning centers; mini-courses; design of physical space; all-school activities. Arnold

ED 577 Improving Classroom Instruction in Science. *Preq.: ED 475 or equivalent. 3(3-0) S, Sum.* Application of major principles of education and psychology to the improvement of science teaching in elementary and secondary schools. Identification and definition of classroom problems, clarification of goals and objectives, selection of instructional strategies, development or selection of science materials, evaluation of achievement in science and establishing a desirable classroom climate. Anderson

ED 579 Concepts and Principles of Evaluation Applied to Non-formal Adult Education Programs. *Preq.: ED 503 or CI. 3(3-0) S.* Introduction to the evaluation of non-formal adult educational programs; course topics include the purposes of evaluation, alternative concepts and techniques, stake holders and their concerns, the specification of evidence, selection of standards for making judgments, gathering and analysis of data, use and dissemination of results and handling problems in evaluation. Wright

ED 580 Evaluation Theory and Practice in Education. *Preq.: ED 532 or equivalent. 3(3-0) F.* A review of educational program evaluation with emphasis on (1) theory and conceptual models of evaluation, (2) evaluation design, and (3) environmental practical factors influencing the design and implementation of evaluation studies. Serow

ED 581 Curriculum and Instruction in the Allied Health Professions. *Preqs.: Advanced undergrad. or grad. standing and CI. 3(3-0) Alt. yrs.* A study of the elements of curriculum design and theoretical considerations for the development of curricula in the health occupations. Identification, analysis and evaluation of instructional strategies appropriate for clinical and classroom teaching. Nunley

ED 582 Teaching Braille and Communication Skills. *Preqs.: ED 513 and ED 545 or equivalent. 3(3-0) S.* Information-access methods for visually impaired learners. Methods

and materials for teaching Braille reading and selecting and teaching the use of electronic aids. Zambone

ED 583 Design and Evaluation of Instructional Materials. *Preq.: ED 483 or CI. 3(3-0) S, Sum.* Emphasis is upon the characteristics and selection of various media for instruction and their use in educational settings. Instructional materials will be designed and produced. Analysis of the research in the field is conducted. Projects and assignments are individualized in the areas of slide/tape, instructional television, instructional computing, graphic design and transparencies. Brooks

ED 584 Health Care Delivery Systems and Environments. *Preqs.: Grad. standing and CI. 3(3-0) Alt. yrs.* Organization of the health care delivery system, services and resources. Focus on the major social, economic, political and professional factors which contribute to shaping the system and influence change. Organizations and environments are analyzed in regard to the demand for health manpower and the implications for health occupations education. Turnbull

ED 585 Community Education. *Preqs.: ED 503 and SOC 513. 3(3-0) S.* This course explores non-formal approaches to education in community settings. History and philosophy of community education, models of institutional response to community, functional dimensions of community education and community education planning are analyzed within the context of matching resources to needs. Students will develop knowledge and skill in the designing of community education as a process and a product. Graduate Staff

ED 586 Methods and Materials in Visual Impairments. *Preqs.: ED 506, ED 513. 3(3-0) S.* A study of current methods and materials for teaching visually impaired learners. Includes curriculum and materials development, adaptation, instructional techniques, educational assessment and diagnosis. Zambone

ED 588 Advanced Teaching Methods in Industrial Arts Education. *Preq.: ED 362 or equivalent. 3(2-2) F, Sum.* An intensive examination of the teaching-learning process applicable to laboratory-classroom instruction. Instructional technology, evaluation, classroom control and management will be given attention. Wenig, Graduate Staff

ED 589 Central Office Administration. *Preq.: ED 550 or equivalent. 3(3-0) F.* A course covering the major responsibilities (except curriculum) of central office administrators in public school districts, *e.g.*, pupil assignments, business affairs, personnel administration, construction and maintenance. Students will combine findings from their readings with present practices to develop workable procedures for solving managerial problems. Williams

ED 590 Special Problems in Guidance. *Preqs.: Six hours grad. work in department or equivalent and CI. Maximum 6 F, S.* Intended for individual or group studies of one or more of the major problems in guidance and personnel work. Problems will be selected to meet the interests of individuals. The workshop procedure will be used whereby special projects, reports and research will be developed by individuals and by groups. Graduate Staff

ED 591 Special Problems in Industrial Education. *Preqs.: Six hours grad. credit in industrial and technical education and CI. Maximum 6 F, S.* Directed individualized study and analysis in specialized areas of trade, industrial or technical subjects. Graduate Staff

ED 592 Special Problems in Mathematics Teaching. *Preq.: ED 471 or equivalent. 1-3 Sum.* An in-depth investigation of topical problems in mathematics teaching chosen from the areas of curriculum, methodology, facilities, supervision and research. Graduate Staff

ED 593 Special Problems in Agricultural Education. *Preqs.: Six hours grad. credit in agricultural education and CI. Credits Arranged. F,S,Sum.* Opportunities for students to study current problems under the guidance of the staff. Graduate Staff

ED 594 Special Problems in Science Teaching. *Preq.: ED 476 or equivalent. 1-3 Sum.* An investigation of current problems in science teaching with emphasis on areas in curriculum, methodology, facilities, supervision and research. Specific problems studied in depth. Opportunities will be provided to initiate research studies. Graduate Staff

ED 596 Topical Problems in Adult and Community College Education. *Preq.: Grad. standing or PBS status. Credits arranged. F,S,Sum.* Study and scientific analysis of problems in adult education and preparation of a scholarly research type of paper. Graduate Staff

ED 597 Special Problems in Education. *Preq.: Grad. standing or PBS status. 1-3 F,S,Sum.* Designed to provide graduate students in education opportunity to study problem areas in professional education under the direction of a member of the graduate faculty. Graduate Staff

ED 598 Special Problems in Curriculum and Instruction. *Preqs.: Six hours of ED or PSY and CI. 1-6 F,S,Sum.* Designed to provide an in-depth study of topical problems in curriculum and instruction selected from the areas of current concern to practitioners in education. Graduate Staff

ED 599 Research Projects in Education. *Preqs.: CI; ED 532 or equivalent. 1-3 F,S,Sum.* A project or problem in research in education for graduate students, supervised by members of the graduate faculty. The research will be chosen on the basis of individual students' interests and is not to be part of thesis or dissertation research. Graduate Staff

FOR GRADUATES ONLY

ED 600 Organizational Concepts and Theories Applied to Adult and Community College Education. *Preqs.: ED 503, PS 502, SOC 541. 3(3-0) F.* This course is designed for present and potential administrators interested in increasing their understanding of organization as a basis for administering effective adult and community college education programs. Graduate Staff

ED 601 Administrative Concepts and Theories Applied to Adult and Community College Education. *Preq.: ED 600 or a comparable course(s) on organizational theory. 3(3-0) S.* Designed for persons interested in building a more consistent philosophy of educational administration, extending and strengthening their understanding of administrative concepts and processes, improving their comprehension of the theoretical and research foundations upon which administrative processes are predicated, and increasing their ability to apply administrative concepts, theories and principles to the management of the complex education system. Graduate Staff

ED 602 Curriculum Theory and Development. *Preqs.: 9 semester hours graduate PSY, ED 502, ED 514 or CI. 3(3-0) S.* A study of theory and research in the behavioral sciences and education designed to provide the theoretical background for the development of elementary and secondary curricula. The knowledge base and skills for critical review of curricula and instructional materials are explored and an opportunity to apply these is provided. Parramore

ED 603 Teaching Mathematics and Science in Higher Education. *Preqs.: ED 570, 592 or 594, grad. standing, CI. 3(3-0) F.* Collegiate mathematics and science instruction is examined with respect to goals and objectives, design of courses and curricula, innovative programs and facilities, and methods and materials for instruction. Graduate Staff

ED 604 Curriculum Development and Evaluation in Science and Mathematics. *Preqs.: 500-level statistics, ED 615 or PSY 535, CI. 3(3-0) S.* A critical study of the elements of curriculum design and theory in mathematics education and science education and the examination of evaluation procedures for assessing educational innovations.

Graduate Staff

ED 605 Education and Supervision of Teachers of Mathematics and Science. *Preqs.: ED 470 or 475 or equivalent, ED 570 or 592 or 594. 3(3-0) S.* The study and development of programs and techniques to promote effective improvement and alteration of the teaching behavior of science and mathematics teachers.

Graduate Staff

ED 606 Remediation of Reading Disabilities. *Preq.: ED 547 or CI. 3(3-0) S.* Advanced approaches to reading remediation are examined including theory and research related to remedial instructional strategies, analyses of instructional designs and evaluations of the effectiveness of intervention programs.

Fox

ED (PS) 607 The Politics of Higher Education. *3(3-0).* (See political science and public administration.)

ED 608 Supervision of Occupational Education. *Preq.: ED 527 or ED 630. 3(3-0) F.* An intensive study of the principles of supervision and the applications of these principles to the occupational education programs being conducted in secondary, postsecondary and adult facilities. Emphasis is placed upon the competencies needed in supervisors in order to effectively discharge their responsibilities in such areas as teacher selection, teacher transfer and promotion, assistance in teacher professional growth, the conduct of workshops and in-service programs for professional and non-professional staff, self-evaluative processes in education, curriculum generation and modification, guidance and counseling provisions and action research.

Clary

ED 609 Planning and Organizing Industrial and Technical Education Programs. *Preqs.: ED 516 and grad. standing. 3(3-0) F.* In this course a study will be made of the influences which impinge upon the development of programs of occupational education. Adequate opportunity will also be provided to examine in detail steps that may be taken to analyze needs for occupational education, to organize for its provision, to study its offerings and to evaluate its results.

Foell

ED 610 Administration of Occupational Education. *Preq.: ED 527 or ED 630. 3(3-0) Alt. S.* An intensive study of the major elements of administrative practice applied to occupational education, as it is being conducted in comprehensive high schools, comprehensive community colleges, technical institutes and area vocational centers. Emphasis is placed upon leadership, personnel management, instructional program management and evaluation, public relations and financial management, in connection with preparatory, part-time, supplementary, extension and adult education program of occupational education.

Belcher, Clary

ED 611 Laws, Regulations and Policies Affecting Occupational Education. *Preq.: ED 527 or ED 630. 3(3-0) S.* A detailed study of legislation (national and state) which applies directly to occupational education. Basic social issues and economic conditions which precipitated the legislation will be studied in depth. A review will also be made of the organizational structure and policies under which national legislation is converted into programs of occupational education.

Foell

ED 612 Finance, Accounting and Management of Occupational Education Programs. *Preq.: ED 610. 3(3-0) Alt. S.* A study of the steps which must be taken in financing a new occupational enterprise, following the determination of curriculum by area study. All financial transactions such as costs of operation, equipment purchase procedures and costs for construction will be investigated in detail.

Belcher

ED 614 Contemporary Educational Thought. *Preqs.: Twelve hours ED; CI. 3(3-0) Alt. S.* This course will be based on a reading and discussion of twentieth-century works in educational philosophy. Such movements as pragmatism, reconstruction, perennialism and existentialism will be considered.
Beezer

ED 615 Special Topics in Health Occupations Education. *Preqs.: 15 semester hrs. and CI. 3-5 F,S,Sum.* Guided independent study of topics that complement the student's program of work and professional goals.
Nunley, Turnbull

ED 616 History of Higher Education in the United States. *Preqs.: Six hours of grad. ED courses and CI. 3(3-0) S.* A study of the history of higher education from the colonial period to the present. Emphasis is on how philosophic, political, social and economic forces influence the function and structure of higher education.
Beezer

ED 618 School Law for the Administrator. *Preq.: ED 518 or equivalent. 3(3-0) F.* A comprehensive study of constitutional, statutory and case law as it relates to elementary and secondary school administration. Emphasis is on legal issues associated with governance, finance, property, personnel and curriculum.
Beezer

ED 620 Cases in Educational Administration. *Preqs.: Grad. standing and CI. 3(3-0) S.* This course utilizes the case study and case simulation approach to the study of school administration. Administrative concepts will be developed and applied to simulated situations and to actual case histories. The administrative process is viewed as a decision-making process. The student will be expected to make decisions after considering alternative courses of action and after projecting probable consequences.
Dolce

ED 621 Internship in Education. *Preqs.: Nine credit hours in grad. level courses and CI. 3-9 F,S,Sum.* Utilizing the participant-observer role, this course requires participation in selected educational situations with emphasis upon development of observational skills, ability to record relevant observations by means of written journals, skills in analyzing experiences identifying critical incidents and projection of events and consequences. The student is required to develop possible alternative courses of action in various situations, select one of the alternatives and evaluate the consequences of the course of action selected.
Graduate Staff

ED 630 Philosophy of Industrial Arts Education. *Preq.: Twelve hours in ED. 3(3-0) Alt. S.* Origins, development of industrial arts education. Philosophical foundations, derivation of objectives and criteria for evaluation. Contributions of the heritage to contemporary concepts of industrial arts education.
Young

ED 631 Vocational Development Theory. *Preq.: Grad. standing or PBS status. 3(3-0) F.* A study of the major theories and constructs of vocational development with implications for counseling and career planning.
Jones

ED 632 Applied Research Methods in Education. *Preqs.: ST 507 and ED 532 or equivalent; Coreq.: ST 508 or CI. 3(1-4) S.* Through the use of simulated educational settings consideration will be given to the development of research proposals or plans, selection and/or development of appropriate measurement instruments and the purposes and functions of various statistical designs and procedures. Simulated data will be prepared and analyzed using computer-based statistical packages, the results will be interpreted and a research report will be produced.
Davies

ED 633 Development and Coordination of School Guidance Programs. *Preq.: Grad. standing or PBS status. 3(3-0) S.* A study of the tasks of organizing, coordinating, evaluating and changing school guidance programs by school counselors. Included are the study of goals, objectives, values, functions and evaluations as they are related to program development in the secondary and elementary school.
Jones

ED 635 Administration and Supervision of Industrial Arts. *Preq.: Twelve hours in ED. 2(2-0) F.S.* Study of the problems and techniques of administration and supervision of industrial arts in schools and universities. Selection of teachers, teacher improvement methods, public relations, facilities planning and specification. Graduate Staff

ED 636 Observation and Supervised Field Work. *Preq.: CI. Maximum 3 F.S.* Provides opportunity for observation and practice of guidance and personnel services in schools, institutions of higher education, agencies, business and industry. Graduate Staff

ED 640 Laboratory Experiences in Counseling. *Preqs.: ED 520 or equivalent; PSY 535; Coreq.: ED 530. 3(3-0) F.* The identification and practice of fundamental skills needed for a person to function as an effective counselor. Emphasized is development of specific skills in: counseling, testing, human relations, identification of client problems and the design of counseling strategies. Graduate Staff

ED 641A Practicum in Counseling. *Preqs.: Advanced grad. standing, CI. 2-6 S.* A practicum course in which the student participates in actual counseling experience under supervision in a school, college or agency setting. Graduate Staff

ED 641B Practicum in Reading. *Preqs.: ED 545 or ED 546 and ED 547 and CI. 1-6 S.* Practicum designed to meet the particular needs of students enrolled. It may involve diagnosis of student abilities, design of a remedial program based on hypothesis concerning student abilities, implementation and evaluation of a remedial reading program, or the design of a reading clinic. Graduate Staff

ED 641C Practicum in Special Education. *Preq.: CI. 1-6 F.S.* Practicum will be designed to meet the individual needs of the students enrolled in the course. The practicum may involve diagnosis of exceptional students, writing educational prescriptive plans for exceptional students, or it may focus on an individual topic that involves working directly with exceptional learners. Graduate Staff

ED 641D Practicum in Science and Mathematics Education. *Preq.: ED 570 or ED 575. 1-6 F.S.* This course is a supervised practicum in appropriate settings both on- and off-campus which provides an opportunity for evaluation development and implementation of an instructional program in science and mathematics in a clinical environment under close faculty supervision. Graduate Staff

ED 641G Practicum in Middle Years Education. *Preqs.: ED 507 or equivalent; grad. standing and CI. 3-6 F.S.* Designed to provide practical experience in schools and area agencies concerned with middle and junior high school education. Arnold

ED 641J Practicum in Health Occupations. *Preqs.: 21 hrs. grad. work including ED 581 and CI. 3(3-0) Alt. yrs.* Based upon the participants' professional objectives, a practicum in a teaching or an administrative context will be designed appropriate to the individual's particular discipline and area of function. Program will be designed by the student in cooperation with the preceptor and course instructor. Nunley, Turnbull

ED 660 Industrial Arts Curriculum. *Preq.: IA 645. 3(3-0) F.S., Sum.* Industrial arts curriculum origins, analysis, organization, evaluation, revision. Subject matter deviation and classification applicable to all levels of instruction. Relationships among curriculum, philosophy and methodology. (Also see ED 608, ED 610, ED 630, ED 635, and ED 692. Graduate Staff

ED 664 Supervision in Agricultural Education. *Preq.: ED 554. 3(3-0) F.S.* Organization, administration, evaluation and possible improvement of supervisory practice; theory, principles and techniques of effective supervision in agricultural education at different levels. Graduate Staff

ED 665 Supervising Student Teaching. *Preq.: Twelve hours of ED. 3(3-0) F,S,Sum.* A study of the program of student teaching in teacher education. Special consideration will be given the role of the supervising teacher, including the following areas: planning for effective student teaching, observation and orientation, school community study, analysis of situation, evaluating student teachers and coordination with North Carolina State University.

Graduate Staff

ED 666 Supervision of Counseling. *Preq.: CI. 3(1-8) F,S.* A supervised practicum for doctoral students in assisting with the supervision of first-year students in laboratory and practicum experiences in individual or group counseling.

Graduate Staff

ED 687 Seminar in Curriculum and Instruction. *Preqs.: Doctoral standing; ED 602 or CI. 1-3 Alt. F.* Consideration of contemporary issues, trends and recent research and development findings in curriculum and instruction.

Graduate Staff

ED 688 Research Application in Occupational Education. *Preq.: ED 532. 3(3-0) F,S.* This course will be concerned with methodology, application, analysis and synthesis of research in occupational education. A review of current occupational education studies, clustered by areas, will be made with attention to statistical techniques, data collecting, data handling, and the audience and impact of particular projects and research organizations. The class activities in research application are designed to bridge the gap between the theories of research methodology and the student's independent research projects.

Coster, Graduate Staff

ED 689 Evaluation in Occupational Education. *Preqs.: ED 532 and either ST 507, ST 511, ST 513 or CI. 3(3-0) F.* Concerned with the conceptual and methodological aspects of occupational education evaluation, with attention to techniques for determining empirically the extent to which educational goals are being achieved, to locate the barriers to the advancement of these goals and to discover the consequences of educational programs.

Coster

ED 690 Seminar in Mathematics Education. *Preq.: Departmental major or CI. 2(2-0) F,S.* An in-depth particular topic(s) in mathematics education.

Graduate Staff

ED 691 Seminar in Industrial Education. *Preqs.: Six hours grad. credit, including one 600-level course in industrial and technical education and CI. 1(1-0) S.* Reviews and reports of special interest to graduate students in industrial and technical education. The course will be offered in accordance with the availability of distinguished professors and in response to indicated needs of the graduate students.

Foell

ED 692 Seminar in Industrial Arts Education. *Preq.: Grad. standing. 1(1-0) F,S.* Reviews and reports on special topics of interest to students in industrial arts education.

Graduate Staff

ED 693 Advanced Problems in Agricultural Education. *Preqs.: Six hours grad. credit, including one 600-level course in agricultural education and CI. Credits Arranged. F,S.* Study of current and advanced problems in the teaching and administration of educational programs, evaluation of procedures and consideration for improving.

Graduate Staff

ED 694 Seminar in Agricultural Education. *Preqs.: Six hours grad. credit, including one 600-level course in agricultural education and CI. 1(1-0) Maximum 2 F.* A critical review of current problems, articles and books of interest to students of agricultural education.

Graduate Staff

ED 695 Seminar in Science Education. *Preq.: Department major or CI. 2(2-0) F,S.* An in-depth examination and analysis of the literature and research in a particular topic(s) in science education.

Graduate Staff

ED 696 Seminar in Adult and Community College Education. *Preq.: Grad. standing. 1-3 F,S.* Identification and scientific analysis of major issues and problems relevant to adult education. Credit for this course will involve the active participation of the student in a formal seminar and scientific appraisal and solution of a selected problem. The course is designed to help the student acquire a broad perspective of issues confronting adult educators and to acquire experiences in the scientific analysis and solution of specific issues.

Graduate Staff

ED 697 Problems of Research Design in Education. *Preqs.: ED 632 and CI. 1-3 F.* Provides the student with an individualized but structured investigation of alternative problem definitions, research methodologies and statistical analyses for a problem of his/her choosing, usually associated with thesis or dissertation. In small groups or individually with the instructor, the student considers research design, measurements and statistical analysis necessary to conduct research.

Graduate Staff

ED 698 Seminar in Occupational Education. *Preq.: ED 527 or ED 630. 3(3-0) F,S.* This course will be designed as a seminar-type course, with topics selected each semester. Attention will be given to the broad concepts of occupational education as manifested in the Vocational Education Act of 1963 and its amendments, and to the problems and issues underlying the development of and implementation of programs of occupational education at elementary, junior high, senior high and postsecondary levels. Coster, Graduate Staff

ED 699 Thesis and Dissertation Research. *Preqs.: 15 hours of education; CI. Credits Arranged. F,S,Sum.* Individual research on a thesis or dissertation problem.

Graduate Staff

Electrical and Computer Engineering

GRADUATE FACULTY

Professor N. A. Masnari, Head

Associate Professor J. F. Kauffman, Graduate Administrator

Professors: W. E. Alexander, W. Chou, W. A. Flood, A. J. Goetze, J. J. Grainger, J. R. Hauser, M. A. Littlejohn, N. F. J. Matthews, L. K. Monteith, J. B. O'Neal Jr., D. R. Rhodes, J. J. Wortman; Adjunct Professors: E. Christian, J. B. Suttle; Visiting Professor: H. W. Etzel; Professors Emeriti: W. J. Barclay, A. R. Eckels, G. B. Hoadley, W. D. Stevenson Jr., F. J. Tischer; Associate Professors: D. P. Agrawal, G. F. Bland, W. T. Easter—Associate Head of the Department, T. H. Glisson, A. A. J. Nilsson, W. E. Snyder, R. J. Trew, H. J. Trussell; Adjunct Associate Professors: S. M. Bedair, J. W. Harrison, J. R. Jones, S. H. Lee, A. Thanikachalam, H. R. Wittmann; Associate Professors Emeriti: N. R. Bell, E. G. Manning, W. C. Peterson; Assistant Professors: S. T. Alexander, S. E. Diehl, A. A. Girgis, W. D. Laidig, G. N. Maracas, T. K. Miller III, S. A. Rajala, D. D. Stancil

The Department of Electrical and Computer Engineering offers the degrees of Master of Electrical Engineering, Master of Science with or without a thesis, and Doctor of Philosophy. Areas of emphasis are electromagnetics, communications, digital systems, power systems, solid state electronics, software systems and computer communications.

The Master of Electrical Engineering degree requires a design project which may account for three to six credits. A specified number of design courses from an approved list must be included in the student's program of courses. The student must also pass a comprehensive oral examination.

Four core courses from an approved list are required for the Master of Science degree without a thesis, and the student must pass a comprehensive oral examination.

The Master of Science degree with thesis has no specified course requirements, but the student must pass a comprehensive oral examination. The thesis may account for as many as six semester hours.

In the more advanced study for the doctorate, a comprehensive understanding of three of the fields listed earlier as areas of emphasis in electrical engineering is required, and specialization appears in part of the course program and in the research problem undertaken.

Advanced courses of a general and fundamental nature are required for those who plan to carry their advanced studies to the level of the doctorate. Minor sequences of study in advanced mathematics, physics or other appropriate disciplines are planned to fit individual needs.

The laboratories in the department are well equipped for research in communications, computers, VLSI design, electromagnetics, solid-state materials and devices, and power systems. Research is in progress in these and other areas.

SELECTED ADVANCED UNDERGRADUATE COURSES

ECE 431 Electronics Engineering. *Preq.: ECE 314. 3(2-3) F.*

ECE 432 Communication Engineering. *Preq.: ECE 431. 3(2-3) S.*

ECE 433 Energy Distribution Control and Application in Industry. *Preq.: ECE 305 or 331. 3(3-0) S.*

ECE 434 Power System Analysis. *Preq.: ECE 305. 3(3-0) F.*

ECE 435 Elements of Control. *Preqs.: ECE 305, ECE 314. 3(2-3) F.*

ECE 441 Introduction to Solid-State Devices. *Preqs.: ECE 303, ECE 314. 3(3-0) F.*

ECE 443 Digital Systems Design. *Preq.: ECE 340. 3(2-3) F.*

ECE 448 Microwave Antennas, Radars and Communication Systems. *Preq.: ECE 303. 3(3-0) S.*

ECE 492 Special Topics in Electrical Engineering. *Preq.: CI. 1-4 F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ECE (CSC, CSE) 501 Design of Systems Programs. *3(3-0) F.* (See computer studies.)

ECE 503 Computer-Aided Circuit Analysis. *Preqs.: ECE 314, 301, B average in ECE and MA. 3(3-0) F.* Analysis of electrical circuits with emphasis on computer methods. Steady-state and transient analysis of linear and nonlinear networks; tolerance analysis; programming considerations.

Graduate Staff

ECE 504 Introduction to the Design of Transmission Networks. *Preqs.: ECE 301, B average in ECE and MA. 3(3-0) S.* Introduction to modern design methods of transmission networks for specified loss, phase, delay or time specifications. To be discussed will be passive, active-RC and digital networks. Design methods will make extensive use of canned computer programs. This course is intended: (a) for engineers who may have to design transmission networks occasionally, (b) for those who specify such networks, (c) as a first introduction for further studies. Graduate Staff

ECE (CSC, CSE) 506 Digital Systems Architecture. *3(3-0) F.* (See computer studies.)

ECE (CSC, CSE) 510 Software Engineering. *3(3-0) F.* (See computer studies.)

ECE 511 Analog Electronics. *Preqs.: ECE 431, grad. standing or B average in ECE and MA. 3(2-3) S.* A study of circuit and system applications of analog devices and integrated circuits. Performance characteristics and limitations of a wide variety of analog electronic devices and circuits will be considered. Selected laboratory projects are used to provide direct experience in advanced analog electronics. Graduate Staff

ECE (CSC, CSE) 512 Compiler Construction. *3(3-0) S.* (See computer studies.)

ECE (CSE) 513 Digital Signal Processing. *Preqs.: ECE 301, ECE 302 or CI, B average in ECE and MA. 3(3-0) F.* Digital processing of analog signals. Offline and real-time processing for parameter, waveshape and spectrum estimation. Digital filtering and applications in speech, sonar, radar, data processing, and two-dimensional filtering and image processing. Graduate Staff

ECE (CSE) 514 Random Processes. *Preqs.: ECE 301, B average in ECE and MA. 3(3-0) F.* Probabilistic descriptions of signals and noise, including joint, marginal and conditional densities, autocorrelation, cross-correlation and power spectral density. Linear and non-linear transformations. Linear least-squares estimation. Signal detection. Graduate Staff

ECE 516 System Control Engineering. *Preq.: ECE 435 or ECE 301. 3(3-0) F.* Introduction to analysis and design of continuous and discrete-time dynamical control systems. Emphasis on linear, single-input, single-output systems using state variable and transfer function methods. Topics include open and closed-loop representation; analog and digital simulation; time and frequency response; stability by Routh-Hurwitz, Nyquist and Liapunov methods; performance specifications; cascade and state variable compensation. Assignments utilize computer-aided analysis and design programs. Graduate Staff

ECE (CSE) 520 Fundamentals of Logic Systems. *Preqs.: ECE 340, B average in ECE and MA. 3(3-0) F.* A study of algebraic structures as related to logic systems, models for switching circuit behavior and their relation to hardware implementation. Includes theoretical treatment of both combinational and sequential logic systems concepts. (Offered F every year, Sum. 1984.) Graduate Staff

ECE (CSE) 521 Digital Computer Technology and Design. *Preq.: ECE (CSE) 520. 3(3-0) S.* A study of the internal structure and organization of digital systems with the computer as a primary focus. The emphasis is on problem description and modeling as required in the design process. The design of all major components in digital systems, including memory, input-output and control utilizing current technology, will be discussed. Graduate Staff

ECE 530 Physical Electronics. *Preqs.: ECE 303, B average in ECE and MA. 3(3-0) F.* A study of the properties of charged particles under the influence of fields and in solid materials. Quantum mechanics, particle statistics, semi-conductor properties, fundamental particle transport properties and lasers. Graduate Staff

ECE 531 Principles of Transistor Devices. *Preq.: ECE 441. 3(3-0) S.* An analysis of the operating principles of transistor structures. Basic semiconductor physics are reviewed and used to provide an explanation of transistor characteristics. Device-equivalent circuits are developed and used to interpret semiconductor-imposed limitations on device performance. Devices analyzed include both metal oxide semiconductor and bipolar type transistor structures. Hauser

ECE 532 Principles of Microwave Circuits. *Preq.: Grad. standing or B average in ECE and MA. 3(3-0) F.* Principles required to understand the behavior of electronic circuits operating at microwave frequencies. This course starts with a review of electromagnetic theory and establishes the techniques required for working with electronic circuits at microwave and millimeter wave frequencies. Circuit components that operate at these frequencies are discussed. Graduate Staff

ECE (CSE) 533 Digital Electronics. *Preqs.: ECE 314, grad. standing or B average in ECE and MA. 3(3-0) S.* A study of digital electronic circuits and functions in integrated package form. Covers circuit analysis and performance parameters for many important circuit families. Manning, Snyder

ECE 537 Microwave Device Characterization Techniques. *Preq.: ECE 448. 3(1-5) F.* A laboratory in principles of microwave characterization and operation of microwave test equipment such as spectrum analyzers, power meters, detectors and network analyzers. Measurements of impedance noise figure, equivalent circuit parameters and frequency response will be performed on various circuit elements and devices. Maracas

ECE 539 Integrated Circuit Technology and Fabrication. *Preq.: ECE 441. 3(2-2) S.* A study of semiconductor device and integrated circuit processing and technology. Covers sample preparation and specification, oxidation, diffusion, ion implantation, photolithography, design rules and measurement techniques. Wortman

ECE 540 Electromagnetic Fields. *Preq.: ECE 448. 3(3-0) S.* A brief review of Maxwell's Equations, constitutive relations and boundary conditions. Power and energy relations for plane waves in isotropic and anisotropic media. Analysis of transmission lines, hollow metallic wave guides and dielectric waveguides. Green functions and applications to radiation and scattering. Electromagnetics and special relativity. Bland, Kauffman, Stancil, Trew

ECE (CSC, CSE) 542 Database Management. *3(3-0) F.* (See computer studies.)

ECE 545 Introduction to Radio Wave Propagation. *Preqs.: ECE 303, B average in ECE and MA. 3(3-0) F.* Characteristics of plane electromagnetic waves in homogeneous and non-homogeneous media with application to tropospheric and ionospheric propagation. Relationships between electron density, collision frequency and complex refractive index, theory of the formation and dynamics of ionospheric layers and theorems for the prediction of ionospheric propagation. Graduate Staff

ECE 550 Power System Operation and Control. *Preqs.: ECE 305 or ECE 331, B average in ECE and MA. 3(3-0) F.* Fundamental concepts of economic operation and control of power systems. Real and reactive power balance. System components, characteristics and operation. Steady state and dynamic analysis of interconnected systems. Tie-line power and load-frequency control with integrated economic dispatch. Graduate Staff

ECE (PY) 552 Introduction to the Structure of Solids. *3(3-0) S.* (See physics.)

ECE (CSE) 558 Image Processing. *Preqs.: CSE 459 and ST 371 or equivalent, FORTRAN programming capability. 3(3-0) Every yr.* Introduction to the basic techniques of image processing. Topics include image formation and perception, digitization, Fourier transform domain processing, restoration and tomographic reconstruction. Graduate Staff

ECE (CSE) 559 Pattern Recognition. *Preqs.: ECE 340 or equivalent, ECE 512, B average in ECE and MA. 3(3-0) S.* A study of image pattern recognition techniques and computer-based methods for scene analysis, including discriminate functions, fixture extraction, classification strategies, edge detection and Fourier image processing. Applications and current research results will be covered. Graduate Staff

ECE (CSC, CSE, IE, OR) 562 Advanced Topics in Computer Simulation. 3(3-0) F. (See computer studies.)

ECE (MAE) 565 Gas Lasers. 3(3-0) F,S. (See mechanical and aerospace engineering.)

ECE (CSC, CSE) 571 Data Transmission/Communications. 3(3-0) S. (See computer studies.)

ECE (CSC, CSE) 572 Computer Communications. 3(3-0) F. (See computer studies.)

ECE (CSC, CSE) 574 Real Time Computer Systems. 3(3-0) Alt. S. (See computer studies.)

ECE 591, 592 Special Topics in Electrical Engineering. *Preq.: B average in technical subjects. 3(3-0) F,S.* A two-semester sequence to develop new courses and to allow qualified students to explore areas of special interest. Graduate Staff

ECE 593 Individual Topics in Electrical Engineering. *Preq.: B average in technical subjects. 1-3 F,S.* A course providing an opportunity for individual students to explore topics of special interest under the direction of a member of the faculty. Graduate Staff

FOR GRADUATES ONLY

ECE 613 Advanced Feedback Control. *Preq.: ECE 516. 3(3-0) S.* The study of advanced topics in dynamical systems and multivariable control. Current research and recent developments in the field will be treated. Graduate Staff

ECE 619 Microwave Circuits Design. *Preq.: ECE 532. 3(3-0) Alt. S.* Techniques for the design of microwave and millimeterwave systems and components. Radar and radiometer systems are introduced and discussed. System-imposed constraints upon component performance are introduced. Component function and design are analyzed. Specific topics include mixer, oscillator and amplifier performance and design. Students are required to design a selected component. Modern computer-aided design techniques are used. Graduate Staff

ECE 622 Electronic Properties of Solid-State Materials. *Preq.: ECE 530. 3(3-0) S.* A review of energy bands in semiconductors. Detailed treatment of thermal and electrical transport phenomena, equilibrium and non-equilibrium semiconductor statistics. Also optical properties and hot electron effects in solid-state materials. Graduate Staff

ECE 623 Optical Properties of Semiconductors. *Preq.: ECE 530. 3(3-0) Alt. F.* Materials and device-related properties of compound optical semiconductors are studied. Included topics are: optical constants, absorption and emission processes in semiconductors, photodetectors, LED's semiconductor lasers. Graduate Staff

ECE 624 Electronic Properties of Solid-State Devices. *Preq.: ECE 530. 3(3-0) S.* A study of the basic physical phenomena responsible for the operation of solid-state devices. The semiconductor equations are examined and utilized to explain basic principles of operation. Rectifying and ohmic contacts are examined. Various state-of-the-art devices are studied in detail. Graduate Staff

ECE 625 Advanced Solid-State Device Theory. *Preq.: ECE 624. 3(3-0) F.* A study of the latest developments in solid-state devices. Topics are selected from subjects of current in-

terest and state-of-the-art results are discussed. Emphasis is on the basic fundamental physical principles of operation as opposed to circuit applications. Graduate Staff

ECE (PY) 627 Semiconductor Thin Films Technology. *Preq.: ECE 530. 3(3-0) Alt. S.* Techniques and processes encountered in the growth and characterization of epitaxial semiconductor films. Examples of growth techniques to be considered are: solution growth, chemical vapor deposition, molecular beam epitaxy and sputtering. Film characterization includes electrical characterization using Hall techniques, optical characterization using x-ray and electron microscopy techniques, surface and thin film analysis such as auger and secondary ion mass-spectrometer. Bedair

ECE 632 Power System Stability and Control. *Preqs.: ECE 434, ECE 516. 3(3-0) S.* Modeling of synchronous machines and their control systems. Coupled electric circuit approach, Park's transformations, additional rotor windings. Rudiments of dynamic and transient stability. Excitation systems, governor-control systems, power-system stabilizers. State space formulations for computer-based dynamic studies. Graduate Staff

ECE 633 Computer Analysis of Large-Scale Power Systems. *Preq.: ECE 550. 3(3-0) F.* Computer-based matrix methods of analysis of large networks. Problem statements, algorithmic formulations and solution techniques emphasizing efficient use of the computer for short-circuit calculations, computations of power flows under normal and emergency conditions and stability studies. Linear programming and optimization methods in power system planning. Graduate Staff

ECE (CSE) 640 Advanced Logic Systems. *Preq.: ECE (CSE) 520. 3(3-0) S.* A study of state-of-the-art concepts in the area of digital systems. The theoretical and technological results and trends as indicated by the current literature will be studied. This course is intended to provide understanding of current advanced concepts as well as provide research background. Graduate Staff

ECE (CSE) 641 Sequential Machines. *Preq.: ECE (CSE) 520. 3(3-0) F.* The study of finite automata, both synchronous and asynchronous. Machine equivalence and minimization, state identification and the state assignment problem. Flip-flop activation from the state diagram and other realization techniques. Graduate Staff

ECE 642 Automata and Adaptive Systems. *Preq.: ECE (CSE) 520. 3(3-0) S.* The study of neural nets in natural systems, artificial nerve nets, artificial intelligence, goal-directed behavior, the logic of automata and adaptive Boolean logic. Computability, Turing machines and recursive function theory. Graduate Staff

ECE (CSE) 651 Statistical Communication Theory. *Preq.: ECE (CSE) 514 or MA (ST) 541. 3(3-0) S.* Waveform analysis including Fourier transforms, correlation functions and other statistical descriptions of stationary and non-stationary random processes. Weiner theory: prediction, estimation and smoothing of discrete and continuous signals; introduction to Kalman filtering; problems to illustrate the applications of the theory to speech, television and data communication systems. Graduate Staff

ECE (CSE) 652 Information Theory. *Preq.: ECE (CSE) 514. 3(3-0) F.* Definition of a measure of information and a study of its properties, information sources and their efficient representation, communication channels and their capacity, encoding and decoding of data for transmission over noisy channels, source encoding systems, error correcting codes, rate distortion bounds. (Offered alt. years.) Graduate Staff

ECE 659 Structural Pattern Recognition. *Preq.: ECE 559. 3(3-0) F.* Analysis of images by computers. Specific attention is given to analysis of the geometric features of objects in im-

ages, such as region size, connectedness and topology. Topics covered include: segmentation, template matching, motion analysis, boundary detection, region growing, shape representation, representation and process of three-dimensional structures. Snyder

ECE (CSC, CSE) 671 Computer Systems Performance Evaluation. 3(3-0) Alt. S. (See computer studies.)

ECE 691, 692 Special Studies in Electrical Engineering. 3(3-0) F.S. An opportunity for small groups of advanced graduate students to study topics in their special fields of interest under the direction of members of the graduate faculty. Graduate Staff

ECE 693 Individual Studies in Electrical Engineering. *Preq.: Grad. standing. 1-3 F.S.* The study of advanced topics of special interest to individual students under the direction of faculty members. Graduate Staff

ECE 695 Electrical Engineering Seminar. *Preq.: Grad. standing in ECE. 1(1-0) F.S.* A series of papers and conferences participated in by the instructional staff, invited guests and students who are candidates for advanced degrees. Graduate Staff

ECE 698 Electrical Engineering Design Project. *Preq.: Grad. standing in ECE. 3-6 F.S.* A course in which a student, or a group of students working as a team, will design and usually build, test, and evaluate an electrical device, system, or process. A written engineering report is required. The oral examination of a candidate for the degree of Master of Electrical Engineering will include questioning on this course. Graduate Staff

ECE 699 Electrical Engineering Research. *Preqs.: Grad. standing in ECE, consent of advisor. Credits arranged.* Graduate Staff

Engineering

These courses are designed for use by graduate students in any department in the School of Engineering.

E (MA, OR) 531 Dynamical Systems and Multivariable Control. 3(3-0) F. (See operations research.)

E (OR) 650 Algorithmic Methods in Optimal Control. 3(3-0) Alt. S. (See operations research.)

English

GRADUATE FACULTY

Professor L. S. Champion, Head

Professor J. D. Durant, Assistant Head

Professor M. C. Williams, Director of the Graduate Program

Professors: P. E. Blank Jr., M. Halperen, M. T. Hester, L. F. Jeffers, A. S. Knowles, B. G. Koonce Jr., W. E. Meyers, M. S. Reynolds, D. D. Short, A. F. Stein, W. B. Toole III, P. Williams Jr.; *Professors Emeriti:* H. G. Kincheloe, F. H. Moore, R.

G. Walser; *Associate Professors*: B. H. Baines, L. J. Betts Jr., E. D. Clark, J. W. Clark Jr., E. D. Engel, H. A. Hargrave, A. H. Harrison, L. T. Holley, M. F. King, D. L. Laryea, L. H. MacKethan, C. R. Miller, C. R. Moore, C. A. Prioli, N. G. Smith, J. J. Smoot, J. N. Wall Jr., H. C. West, R. V. Young; *Associate Professor Emeritus*: E. P. Dandridge Jr.; *Assistant Professors*: G. W. Barrax, J. M. Grimwood, R. W. Kelton, J. J. Kessel

The Department of English offers instruction leading to the Master of Arts degree in English and American Literature. The program is designed either to provide the student with a terminal course of study or to serve as the first year toward a doctorate. A minimum of 30 semester hours of graduate credit is required, though the program may be expanded to meet the needs of individual students.

A student may choose a 37-hour program which includes a concentration in composition consisting of four courses in rhetoric, linguistics and the teaching of composition.

The student who holds "A" certification from the N. C. Department of Public Instruction may pursue a Master of Arts with Graduate Certification. This program involves a minimum of 30 semester hours of graduate credit in English and 9 semester hours of graduate credit in education.

The student who holds "A" certification may also pursue advanced or sixth-year certification, a program requiring 21 to 60 semester hours of graduate study of English, education and elective courses, depending upon the level of preparation brought to the program.

Assistantships for promising students are available. These students will take ENG 504 in the fall semester and, under supervision, devote half time in subsequent semesters to the teaching of courses in freshman composition.

North Carolina State University is a member of the Folger Institute of Renaissance and Eighteenth-Century Studies, a unique collaborative enterprise sponsored by the Folger Shakespeare Library in Washington, D.C., and twenty universities in the Middle Atlantic region. Each year the Institute offers an interdisciplinary program in the humanities—seminars, workshops, symposia, colloquia and lectures. Admission is open to faculty and students of North Carolina State University, and a limited number of fellowships are available through the Campus Folger Institute Committee.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

NOTE: The prerequisite for all 500-level English courses is upper division or graduate standing.

ENG 504 Problems in College Composition. *Preq.: Grad. standing. 3(3-0) F.* Study of the history and theory of rhetoric; practice in writing and in literary analysis; preparation for the profession of teaching composition and literature. Required of all teaching assistants in English. MacKethan

ENG 561 Milton. *3(3-0) S.* An intensive reading of Milton with attention to background materials in the history and culture of seventeenth-century England. Wall, Young

ENG 575 Southern Writers. *3(3-0) S.* A survey of the particular contribution of the South to American literature, with intensive study of selected major figures.

Grimwood, Laryea

ENG 578 English Drama to 1642. *Preqs.: ENG 261 and upper division or grad. standing. 3(3-0) Alt. F.* Study of English drama from its beginnings in cycle plays to the closing of the theaters. Emphasis is placed on Elizabethan and Jacobean drama, excluding Shakespeare. (Offered in 1984.)

Baines, M. Williams

ENG 579 Restoration and 18th-Century Drama. *3(3-0) Alt. S.* Intensive study of the English drama from 1660 to 1800. (Offered in 1984.)

Durant

ENG 590 Literary Criticism. *3(3-0) Alt. S.* An examination of the critical process as it leads to the definition and analysis of literature, together with attention to the main literary traditions and conventions.

Holley, P. Williams

FOR GRADUATES ONLY

NOTE: The prerequisite for all 600-level English courses is graduate standing unless additional prerequisites are noted.

ENG 609 Old English Literature. *3(3-0) Alt. S.* An introduction to the language and literature of the Old English period (450-1100). Readings will be in the original and will include both poetry and prose. (Offered in 1986.)

Short

ENG 610 Middle English Literature. *3(3-0) Alt. S.* A study of major works of medieval English literature (exclusive of Chaucer) in the light of dominant intellectual and artistic traditions: emphasis is on four works: *Piers Plowman*, *Pearl*, *Sir Gawain and the Green Knight*, and Malory's *Morte d'Arthur*. (Offered in 1985.)

Holley, Koonce

ENG 615 American Colonial Literature. *3(3-0) F.* A study of American literature and thought from the beginning to the adoption of the Constitution. (Offered in 1985.)

J. Clark, Prioli

ENG 620 16th-Century Non-Dramatic English Literature. *3(3-0) F.* A detailed survey of non-dramatic prose and verse of the sixteenth century against the background of Humanism with the consequent assimilation of classical and continental literary subjects and forms.

Blank, Hester, Wall

ENG 624 Modern English Usage. *3(3-0) Alt. F.* An intensive study of English grammar, with attention to new developments in structural linguistics and with emphasis on current usage. (Offered in 1984.)

Meyers, Short

ENG 626 History of the English Language. *3(3-0) Alt. F.* A survey of the growth and development of the language from its Indo-European beginnings to the present. (Offered in 1985.)

Meyers, Short

ENG 630 17th-Century English Literature. *3(3-0) S.* A close examination of the literature of England from 1600 to 1700 with emphasis on major literary figures and movements, the development of important literary forms and genres, and the intimate relationship between the literature of this period and its philosophical, political and theological backgrounds.

Hester, Wall, Young

ENG 650 English Romantic Period. 3(3-0) *F*. A detailed study of the six major romantic poets—Blake, Wordsworth, Coleridge, Byron, Shelley, and Keats; some attention as well to the political, social and literary background and to a few minor writers and critics.

Hargrave, Harrison, P. Williams

ENG 651 Chaucer. *Preqs.: ENG 451 or equivalent and grad. standing.* 3(3-0) *F*. An intensive study of the Chaucer canon requiring independent research.

Holley, Koonce, Meyers, Short

ENG 655 American Romantic Period. 3(3-0) *F*. A study of the selected works of Poe, Hawthorne, Melville, Emerson, and Thoreau, with emphasis on their varied contributions to the literature and thought of the American romantic movement. MacKethan, Stein, West

ENG 658 Studies in Shakespeare. *Preqs.: ENG 486 or ENG 487 or equivalent and grad. standing.* 3(3-0) *F,S*. An intensive study of a particular phase of the Shakespeare canon. Emphasis will normally be on one dramatic genre (tragedy, comedy, history), but occasionally the focus may be more limited. Students may register for credit for a maximum of six hours.

Baines, Champion, M. Williams

ENG 660 Victorian Poetry and Critical Prose. 3(3-0) *S*. Studies in the literature of Victorian England: 1837-1901; the major poets and essayists, movements and questions in their historical contexts, religious, political and aesthetic.

Hargrave, Harrison, King

ENG 662 18th-Century English Literature. 3(3-0) *F*. The major figures in English literature between 1660 and 1790 against the background of social, cultural and religious change.

Durant, C. Moore

ENG 663 18th-Century English Novel. 3(3-0) *Alt. S*. Selected British novels of the eighteenth century studied in relation to the history and development of the genre and in the light of available critical opinion past and present. (Offered in 1985.)

Durant, C. Moore

ENG 664 Victorian Novel. 3(3-0) *Alt. F*. The nineteenth-century British novel studied from the perspective of literary history and twentieth-century criticism. (Offered in 1985.)

Engel, King

ENG 665 American Realism and Naturalism. 3(3-0) *S*. Concentration on Whitman, Dickinson, Twain, James and Dreiser, with briefer attention to Howells, Crane, Norris and other realists and naturalists.

MacKethan, Stein, West

ENG 670 20th-Century British Prose. 3(3-0) *Alt. F*. An examination of the works of the major British writers and literary movements of this century and their historical context, religious, political and aesthetic. (Offered in 1985.)

Halperen, Knowles, Reynolds

ENG 671 20th-Century British Poetry. 3(3-0) *Alt. S*. The development of English poetry from the rebellion against Victorian and Pre-Raphaelite verse to the present post-war scene; special attention to Hardy, Yeats, Eliot, Auden and Thomas. (Offered in 1986.)

Halperen, Knowles, Reynolds

ENG 675 20th-Century American Prose. 3(3-0) *Alt. F*. An examination of representative American writers of the novel and short fiction. (Offered in 1984.)

Halperen, Knowles, Reynolds

ENG 676 20th-Century American Poetry. 3(3-0) *Alt. S*. The development of modern American poetry from the rebellion against the romantic and genteel verse of the 1890's; special attention to Robinson, Frost, Pound, Williams, Stevens and Ransom. (Offered in 1985.)

Halperen, Knowles, Reynolds

ENG 680 20th-Century British Drama. 3(3-0) *Alt. F.* A survey of modern British drama from its beginnings at the turn of the century to the present. (Offered in 1984.)

Halperen, Knowles

ENG 681 20th-Century American Drama. 3(3-0) *Alt. F.* A survey of modern American drama centering on major figures. (Offered in 1985.)

Halperen, Knowles

ENG 691 Special Topics in Written Communication. *Preq.: One 200-level writing course.* 3(3-0) *S.* Intensive study of issues in written communication, with special emphasis on application of theory to problems in a variety of areas. Seminar discussions and independent research.

Kelton, Miller

ENG 692 Special Topics in American Literature. *Preq.: Consent of seminar chairman.* 3(3-0) *F,S.* An intensive study, involving independent research and centering on some limited topics from American literature.

Graduate Staff

ENG 693 Special Topics in English Literature. *Preq.: Consent of seminar chairman.* 3(3-0) *F,S.* An intensive study, involving independent research and centering on some limited topic from English literature.

Graduate Staff

ENG 698 Bibliography and Methodology. 1-3. Intensive study of the bibliography and methodology of literary research. Required of all graduate students in English.

Graduate Staff

ENG 699 Research in Literature (Thesis). *Preq.: Consent of graduate adviser. Credits Arranged.* *F,S.* Independent investigation of an advanced literary or linguistic problem leading to the writing of a master's thesis.

Thesis Director

Entomology

GRADUATE FACULTY

Professor R. J. Kuhr, Head

Professors: R. C. Axtell, J. R. Bradley Jr., W. M. Brooks, W. V. Campbell, W. C. Dauterman, M. H. Farrier, F. E. Guthrie, Ernest Hodgson, H. B. Moore Jr., H. H. Neunzig, R. L. Robertson, G. C. Rock, T. J. Sheets, R. E. Stinner, J. W. Van Duyn, C. G. Wright; *Adjunct Professors:* A. L. Chasson, J. R. Fouts, F. L. Hastings, R. A. Neal; *Professors Emeriti:* K. L. Knight, W. J. Mistic Jr., R. L. Rabb, C. F. Smith, D. A. Young; *Associate Professors:* J. T. Ambrose, C. S. Apperson, J. S. Bacheler, J. R. Baker, F. P. Hain, G. G. Kennedy, J. R. Meyer, K. A. Sorensen; *Adjunct Associate Professors:* J. R. Bend, H. B. Matthews Jr., R. M. Philpot; *Extension Associate Professor:* R. C. Hillmann; *Assistant Professors:* J. J. Arends, L. L. Deitz, F. L. Gould, G. J. House, R. P. Lampert, P. S. Southern

ASSOCIATE MEMBERS OF THE DEPARTMENT

Professor: D. S. Grosch; *Associate Professor:* B. C. Haning

The Department of Entomology* offers graduate training leading to the Master of Science, Master of Agriculture (non-thesis) and Doctor of Philosophy degrees.

*This department does require GRE scores.

Major areas of specialization are acarology, agricultural entomology, apiculture, behavior, ecology, forest entomology, host-plant resistance, invertebrate pathology, medical and veterinary entomology, nutrition, pesticide analysis, movement and fate of pesticides in soil and water, pest management, population dynamics, soil entomology, systems analysis, taxonomy and toxicology.

Opportunities exist for training in both applied and fundamental phases of entomology. Population management concepts are emphasized in the applied entomology and pest management programs. The applied phases are influenced by the State's agriculture, in which corn, tobacco, cotton, peanuts, soybeans, small grains, fruits, vegetables, livestock and forestry are important components. The rapidly expanding tourist industry and the diverse habitats of the State, extending from the mountains to the sea, provide unique opportunities for research on insects and related arthropods affecting man. A cooperative arrangement with the School of Forest Resources provides majors in forest entomology. The program in medical and veterinary entomology includes both applied and fundamental research and provides the opportunity for training at the School of Public Health, UNC, Chapel Hill. Students electing graduate work in entomology are expected to have strong backgrounds in biological sciences, chemistry and mathematics. Undergraduate preparation in entomology is not required.

Strong interdepartmental programs in ecology, physiology and toxicology include faculty members from the Department of Entomology and provide graduate training for entomology students desiring interdisciplinary graduate degrees. Additionally, interinstitutional courses are available on the nearby campuses of Duke University and the University of North Carolina at Chapel Hill. The presence of numerous federal and industry laboratories in the nearby Research Triangle Park further enhances entomology graduate training.

The departmental research, extension and training programs are housed in a complex of facilities including a pesticide residue research laboratory, biochemistry and toxicology laboratories, insect rearing rooms, greenhouses and field stations. An adjacent phytotron or bioclimatic facility provides an opportunity for ecological and behavioral studies under controlled conditions. Ultrastructural investigations are conducted in the electron microscope facility of the School of Agriculture and Life Sciences. Extensive computer facilities and statistical services are available on campus.

See page 22 for a description of the Pesticide Residue Research Laboratory.

SELECTED ADVANCED UNDERGRADUATE COURSES

ENT (ZO) 425 General Entomology. *Preq.: ZO 201 or equivalent. 3(2-3) F,Sum.*

Related Course:

PM 415 Principles of Pest Management. *Preqs.: BO (ZO) 360, PP 315, ENT 312; Coreq.: CS 414. 4(3-3) S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ENT 502 Insect Diversity. *Preq.: ENT 425 or equivalent. 4(2-4) F.* Surveys the diversity of insect biology and structure emphasizing the identification of adults; speciation, evolutionary relationships, approaches to classification, nomenclature, zoogeography and techniques of collection. Deitz

ENT 503 Functional Systems of Insects. *Preqs.: Twelve hours of biology, nine hours of CH, three hours of BCH, ENT 301 or equivalent. 4(2-6) S.* The morphology, histology and function of the organ systems of insects. Sensory and general physiology lead into basic elements of insect ecology, orientation and behavior. Graduate Staff

ENT (ZO) 509 Ecology of Stream Invertebrates. *4(2-6) S.* (See zoology.)

ENT 520 Insect Pathology. *Preqs.: Introductory entomology and introductory microbiology. 3(2-3) S.* A treatment of the noninfectious and infectious diseases of insects, the etiological agents and infectious processes involved, immunological responses and applications. (Offered S 1985 and alt. years.) Brooks

ENT (BO, CS, PM, PP) 525 Biological Control. *4(3-3) Alt. F.* (See pest management.)

ENT 531 Insect Ecology. *Preqs.: ENT 425 and BO (ZO) 560 or equivalent. 3(2-2) Alt. F.* The interrelationships among insects and components of their effective environments which result in dynamic spatial and temporal patterns of particular species. Also, the diverse roles of insects in the structure and function of communities and ecosystems. (Offered F 1984 and alt. years.) Gould

ENT 541 Immature Insects. *Preq.: ENT 502 or equivalent. 3(1-4) Alt. F.* Biology and taxonomy of immature insects with emphasis on identification of the larval stage of holometabolous orders. A collection of immatures and associated reared adults is required. (Offered F 1984 and alt. years.) Neunzig

ENT 542 Acarology. *Preq.: ENT 301 or 312 or ZO 201. 3(2-3) S.* A systematic survey of the mites and ticks with emphasis on identification, biology and control of the more common and economic forms attacking material, plants and animals including man. (Offered S 1985 and alt. years.) Farrier

ENT 550 Fundamentals of Insect Control. *Preq.: ENT 312 or 301. 3(2-2) F.* The principles underlying modern methods for protecting food, clothing, shelter and health from insect attack. Guthrie

ENT 562 Insect Pest Management in Agricultural Crops. *Preq.: ENT 550. 3(3-0) Alt. S.* Critical review of the biology and ecology of representative beneficial and injurious insects and arachnids of agricultural crops and the advantages and limitations of advanced concepts of their management in selected agroecosystems. (Offered S 1985 and alt. years.)

Bradley, Kennedy, Rock

ENT (FOR) 565 Advanced Forest Entomology. *Preq.: ENT 301 or ENT 502 or CI. 3(2-2) S.* Covers the important insect pests of forest and shade trees including regeneration pests, defoliating insects, inner-bark borers, wood borers, sucking insects, and bud, twig and root feeding insects. Also includes concepts in forest pest management and population dynamics. (Offered S 1984 and alt. years.) Hain

ENT 570 Behavior of Insects. *Preq.: ENT 503 or ZO 510. 3(2-3) F.* A review of the sensory capacities, the central nervous system and the endocrines of insects if followed by simple neural coordinative and integrative mechanisms and species-typical behavior. The develop-

ment (including learning), programming and evolution of behavior are followed by complex behavior associated with sociality, ecological situations and stresses, and communications modes. (Offered F 1984 and alt. years.)
Graduate Staff

ENT (PHY, ZO) 575 Physiology of Invertebrates. 3(3-0) S. (See physiology.)

ENT (ZO) 582 Medical and Veterinary Entomology. *Preqs.: ENT 301 or 312 and ZO 315 or equivalent.* 3(2-3) S. The morphology, taxonomy, biology and control of the arthropod parasites and disease vectors of man and animals. The ecology and behavior of vectors in relation to disease transmission and control. (Offered S 1984 and alt. years.)
Axtell

ENT 590 Special Problems. *Preq.: CI. Credits Arranged. F.S.* Original research on special problems in entomology not related to a thesis problem. Provides experience and training in research.
Graduate Staff

ENT 592 Agricultural Entomology Practicum. *Preq.: Economic entomology (ENT 562 recommended).* 3(0-9) Alt. Sum. Practical experience in research, extension and commercial aspects of insect pest management on a broad range of agricultural crops under actual field conditions. Class meets 9 hours each Friday for 10 weeks from early June to mid August. Students should register for second summer session. (Offered Sum. 1985 and alt. years.)
Bradley

FOR GRADUATES ONLY

ENT 622 Insect Toxicology. *Preqs.: ENT 550, BCH 551 or equivalent.* 3(2-3) S. The relation of chemical structure to insect toxicity, the mode of action of toxicants used to kill insects, the metabolism of insecticides in plant and animal systems, the selectivity within the cholinesterase inhibitors and other selective mechanisms and the analysis of insecticide residues will be discussed. (Offered S 1984 and alt. years.)
Dauterman, Guthrie

ENT 690 Seminar. *Preq.: Grad. standing in ENT or closely allied fields.* 1(1-0) F,S. Discussion of entomological topics selected and assigned by seminar chairman.
Graduate Staff

ENT 699 Research. *Preq.: Grad. standing. Credits Arranged. F.S.* Original research in connection with thesis problem in entomology.
Graduate Staff

Fiber and Polymer Science

ASSOCIATED GRADUATE FACULTY

Professors: D. R. Buchanan, D. M. Cates, J. A. Cuculo, A. H. M. El-Shiekh, R. E. Fornes, T. W. George, R. D. Gilbert, P. L. Grady, B. S. Gupta, D. S. Hamby, S. P. Hersh, H. B. Hopfenberg, P. R. Lord, R. McGregor, M. H. M. Mohamed, H. G. Olf, V. T. Stannett, M. H. Theil, C. Tomasino, P. A. Tucker Jr., W. K. Walsh, W. M. Whaley, C. F. Zorowski; *Adjunct Professors:* J. E. Hendrix, H. F. Mark, A. A. Volpe; *Professors Emeriti:* J. F. Bogdan, D. W. Chaney, G. Goldfinger, H. A. Rutherford, R. W. Work; *Associate Professors:* R. L. Barker, S. K. Batra, T. H. Guion; *Adjunct Associate Professor:* T. Murayama; *Associate Professor Emeritus:* T. G. Rochow

Fiber and polymer science is a multidisciplinary program bringing together the disciplines of mathematics, chemistry and physics and the application of engineer-

ing principles for the development of independent scholars versed in the field of fiber materials science. The program is administered by the School of Textiles and leads to the degree of Doctor of Philosophy. Students majoring in the physical sciences, mathematics, textiles or engineering and having at least a "B" grade in their undergraduate major will normally qualify for admission.

Fiber and polymer science is concerned with polymeric materials, fibers produced from them, fiber assemblies in one-, two- and three-dimensional forms and chemical modification of fiber assemblies. This broad field of study permits a wide range of useful concentrations. The candidate is expected to penetrate deeply into one area of specialization and to acquire a reasonable perspective in other relevant subject matter. Generally specialization occurs within the area of (1) polymer chemistry and synthesis, (2) fiber and polymer physics and physical chemistry, (3) structural mechanics of textile materials or (4) dyeing and chemical modification of textile materials. The student's research is based within one of these areas.

Ample laboratory space is available and there are a number of specialized laboratories equipped to support doctoral investigations. Other facilities and research equipment which may be used in fiber and polymer science research programs are available in cooperating departments on campus. The Burlington Textiles Library houses one of the most complete collections of polymer, fiber and textile literature.

DEGREE REQUIREMENTS

Doctor of Philosophy—An advisory committee chaired by a member of the fiber and polymer science faculty is formed as soon as possible to develop with the student a plan of study designed to enable one to acquire the comprehensive knowledge required to pass the qualifying cumulative examinations.

There are no definite requirements in credit hours for the Doctor of Philosophy degree. A student's program of study is designed around the student's special interests, while maintaining the coherence and breadth essential for professional development and excellence in research. A reading knowledge of one foreign language is required.

Doctor of Philosophy Minor—Ph.D. candidates who designate a named minor in fiber and polymer science will be required to take nine credit hours in related courses approved by the minor representative on the student's advisory committee.

Communications concerning this program should be directed to the Chairman of the Committee for the Fiber and Polymer Science Program, School of Textiles, North Carolina State University.

COURSE OFFERINGS*

(See departmental listing for descriptions.)

*Extensive use may be made of graduate course offerings in other schools on campus when developing the minor field.

GENERAL COURSES

T 402 Introduction to the Theory and Practice of Fiber Formation.

TC (CH) 461 Introduction to Fiber-Forming Polymers.

TC 504 Fiber Formation—Theory and Practice.

TC (CH) 562 Physical Chemistry of High Polymers—Bulk Properties.

TX 561 Mechanical and Rheological Properties of Fibrous Material.

TX 563 Characterization of Structure of Fiber Forming Polymers.

TC 591 Special Topics in Textile Science.

COURSES IN AREAS OF SPECIALIZATION*Polymer Chemistry and Synthesis*

TC 520 Chemistry of Dyes and Color.

TC 521 Dye Synthesis Laboratory.

TC 530 The Chemistry of Textile Auxiliaries.

TC 561 Organic Chemistry of High Polymers.

TC (CHE) 671 Special Topics in Polymer Science.

Polymer Physics and Physical Chemistry

T 500 Fiber and Polymer Microscopy.

TC 504 Fiber Formation—Theory and Practice.

TC 505 Theory of Dyeing.

TC (CH) 562 Physical Chemistry of High Polymers—Bulk Properties.

TC 662 Physical Chemistry of High Polymers—Solution Properties.

TC (CHE) 569 Polymers, Surfactants and Colloidal Materials.

TC (CHE) 570 Radiation Chemistry and Technology of Polymeric Systems.

TC (CHE) 669 Diffusion in Polymers.

TX 562 Physical Properties of Fiber Forming Polymers, Fibers and Fibrous Structures.

TX (TC) 691 Special Topics in Fiber Science.

Mechanics of Textile Materials and Processes

TX 520 Yarn Processing Dynamics.

TX 549 Warp Knit Engineering and Structural Design.

TX 555 Production Mechanics and Properties of Woven Fabrics.

TX 640 Physical and Mechanical Properties of Knitted Fabrics.

TX 663 Mechanics of Twisted Structures.

TX 664 Mechanics of Fabric Structures.

Food Science

GRADUATE FACULTY

Professor D. R. Lineback, Head

Professors: L. W. Aurand, H. B. Craig, D. D. Hamann, H. N. Jacobson, V. A. Jones—*Graduate Administrator:* H. E. Swaisgood, C. T. Young; *Extension Professors:* F. R. Tarver Jr., F. B. Thomas; *Professors (USDA):* H. P. Fleming, W. M. Walter Jr.; *Adjunct Professor:* R. A. Neal; *Professors Emeriti:* T. N. Blumer, E. S. Cofer, M. W. Hoover, I. D. Jones, W. M. Roberts, M. L. Speck, F. G. Warren; *Professor Emeritus (USDA):* T. A. Bell; *Associate Professors:* H. R. Ball Jr., D. E. Carroll Jr., G. L. Catignani, A. P. Hansen, H. M. Hassan, T. R. Klaenhammer, T. C. Lanier, L. G. Turner; *Associate Professor (USDA):* R. F. McFeeters; *Assistant Professors:* E. A. Foegeding, P. M. Foegeding, J. T. Keeton, S. J. Schwartz, B. W. Sheldon, K. R. Swartzel; *Assistant Professor (USDA):* M. A. Daeschel

Programs of study leading to the Master of Agriculture, Master of Science and Doctor of Philosophy degrees are offered by the Department of Food Science.

Areas of study and research include food chemistry, food microbiology, food engineering, nutrition and food process and product development. These areas involve all foods including dairy products, fruits, meats, poultry products, seafood, nutmeats and vegetables. Supporting course work and cooperative research are offered in areas such as biochemistry, chemistry, economics, engineering, genetics, microbiology, nutrition, physics and statistics.

Because of the diversity of disciplines and wide range of opportunities in food science, each student and his advisory committee are granted considerable flexibility in developing a graduate program tailored to the student's interests and research needs. Each program is expected to contain at least one semester of Seminar in Food Science (FS 690) and the program must conform to guidelines of the Graduate School (see Graduate Programs). All graduate students are eligible for assignment as laboratory assistants in food science courses. The Master of Science program requires a minimum of 30 semester hours of work including a thesis. The Master of Agriculture program requires a minimum of 36 semester hours. No thesis is required, but at least four semester hours of special problems are required. There are no requirements for 600-level courses in the Master of Agriculture program. The Ph.D. program requires at least six semester hours of research. The total semester hours of work are established by the advisory commit-

tee to meet the objectives of the student's program. No foreign language is required.

The department participates in interdepartmental graduate student training programs such as marine science, environmental sciences, nutrition and public health.

Excellent laboratory, pilot plant, library and computer facilities, as well as graduate assistantships, are available to support qualified candidates.

SELECTED ADVANCED UNDERGRADUATE COURSES

FS 400 Foods and Nutrition. *Preq.: CH 220. 3(3-0) S.*

FS 402 Food Chemistry. *Preq.: CH 220 or CH 221. 3(2-3) F.*

FS (PO) 404 Poultry Products. *Preq.: CH 220 or CH 221. 3(2-3) F.*

FS (MB) 405 Food Microbiology. *Preq.: MB 401. 3(2-3) F.*

FS (ANS) 409 Meat and Meat Products. *Preq.: CH 220. 3(2-3) S.*

FS 410 Dairy Products. *Preqs.: FS 331, FS 402, CH 220; Coreq.: MB 401. 3(2-3) S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

FS 503 Food Analysis. *Preq.: FS 402. 3(1-6) S.* A study of the principles, methods and techniques for quantitative physical and chemical analyses of food and food products. Results of analyses evaluated in terms of quality standards and governing regulations.

Young

FS 504 Food Proteins and Enzymes. *Preq.: FS 402 or BCH 451. 3(2-3) Alt. F.* An advanced course in food chemistry with emphasis on proteins and enzymes of particular importance to foods. Protein interactions and their effect on the physical-chemical characteristics of a product will be discussed. Particular emphasis will be given to the preparation and kinetic properties of immobilized enzymes and their use as biochemical reactors in processing operations or as specific electrodes for analytical purposes.

Swaigood

FS (MB) 506 Advanced Food Microbiology. *Preq.: FS (MB) 405 or equivalent. 3(1-6) S.* The interactions of microorganisms in foods and their roles in food spoilage and bioprocessing. Cellular and molecular relationships in bacterial injury, repair and aging resulting from environmental stresses. Bacterial sporulation, germination and physiological properties of bacterial spores.

Graduate Staff

FS 511 Food Research and Development. *Preqs.: FS 331, FS 402, FS (MB) 405. 3(2-3) S.* A study of the scientific principles underlying the development of new and improved food products and processes. The study of specific food industry problems by the case method. Special emphasis on the application of research and development principles to meat, poultry and fisheries industries.

Lanier

FS 516 Quality Control of Food Products. *Preqs.: FS 331, FS 402, FS (MB) 405. 3(2-3) S.* A study of quality control fundamentals in the food industry including specifications and standards, testing procedures, sampling, statistical quality control and organization. Food products and industry problems with special emphasis on dairy products.

Graduate Staff

FS (HS) 521 Food Preservation. *Preqs.: MB 401 or FS (MB) 405, FS 402, or BO 421. 3(2-3) F.* An examination of principles and methods employed in the preservation of foods. Major emphasis on thermal, freezing, drying and fermentation processes and their relationship to physical, chemical and organoleptic changes in product. The relationship of these preservation techniques to the development of an overall processing operation. Carroll

FS (HS) 562 Post-Harvest Physiology. *3(3-0) S.* (See horticultural science.)

FS (BAE) 585 Biorheology. *Preqs.: PY 205, MAE 314. 3(2-2) Alt. S.* The concepts of strain, stress and the mechanical viscoelastic properties of biological solids, fluids and slurries. The time-dependent deformation and flow of bio-materials, elements of strength of materials, rheological equations and model concepts, creep-relaxation and dynamic behavior, contact problems and the Boltzmann superposition principle as a function of time, temperature and moisture content. Hamann

FS 591 Special Problems in Food Science. *Preq.: Grad. or sr. standing. Maximum 6. F,S,Sum.* Analysis of scientific, engineering and economic problems of current interest in foods. The problems are designed to provide training and experience in research. Graduate Staff

FOR GRADUATES ONLY

FS 601 Physical Measurements of Biopolymers. *Preqs.: CH 231 or CH 431, FS 504 or BCH 551. 3(2-3) Alt. S.* The theory of methods commonly used to physically characterize biopolymers will be discussed. Interpretation and limitations of measured values of various physical parameters will be stressed. Particular emphasis will be given to the experimental design and interpretation of the data obtained which will yield the maximum amount of information. Swaisgood

FS (NTR) 606 Vitamin Metabolism. *2(2-0) F.* (See nutrition.)

FS 690 Seminar in Food Science. *1(1-0) F,S.* Preparation and presentation of scientific papers, progress reports and research and special topics of interest in foods. Swaisgood

FS 691 Special Research Problems in Food Science. *Credits Arranged. F,S,Sum.* Directed research in a specialized phase of food science designed to provide experience in research methodology and philosophy. Graduate Staff

FS 699 Research in Food Science. *Credits Arranged. F,S,Sum.* Original research preparatory to the thesis for the Master of Science or Doctor of Philosophy degree. Graduate Staff

Foreign Languages and Literatures

GRADUATE FACULTY

Professor A. A. Gonzalez, Head

Professors: M. Paschal, E. M. Stack, J. H. Stewart; Professor Emeritus: G. W. Poland; Associate Professors: G. Gonzalez, J. R. Kelly, E. W. Rollins, G. G. Smith, H. Tucker Jr., M. A. F. Witt; Assistant Professor: A. Malinowski

The Department of Foreign Languages and Literatures offers courses to assist graduate students in preparing themselves to use modern foreign languages in

research and advanced study. These courses are not open to undergraduate students. Students are encouraged particularly to seek useful foreign research related to their thesis or other research in progress.

Certification may be obtained in languages not normally taught by the department with special permission of the Graduate School.

***FLF 401 French for Graduate Students.** 3(3-0) F. Development of basic vocabulary, knowledge of structures and translation techniques necessary to a reading skill. This course is provided to assist graduate students to prepare for the foreign language reading certification. It does not provide instruction in original composition or in speaking. Students will be certified in the language after successfully passing the final examination. (No prerequisite.)

***FLG 401 German for Graduate Students.** 3(3-0) F. This course seeks to teach the structures and patterns of the language as used in technical and scholarly writing, with emphasis on the acquisition of a basic vocabulary. Examples will be drawn from a variety of sources to reflect the interest of all students. Completion of the course, including the final examination, will certify the student in the language. (No prerequisite.)

***FLS 401 Spanish for Graduate Students.** 3(3-0) F. A course designed to teach students to read Spanish as used in scholarly and technical writing. Material will be drawn from various sources reflecting student interest. Students completing the course, including the final examination, will be certified in the language. (No prerequisite.)

Forestry

GRADUATE FACULTY

Professor A. W. Cooper, Head

Professors: E. B. Cowling, C. B. Davey, M. H. Farrier, E. C. Franklin, L. F. Grand, W. L. Hafley, A. E. Hassan, D. L. Holley Jr., R. C. Kellison, T. O. Perry, L. C. Saylor, A. L. Sullivan, R. R. Wilkinson, A. G. Wollum II; *Professor (USDA):* D. E. Moreland; *Professors (USFS):* F. E. Bridgwater Jr., G. Namkoong; *Adjunct Professors:* J. D. Hair, G. H. Hepting, A. Krochmal, L. J. Metz, C. G. Wells; *Professors Emeriti:* J. W. Duffield, J. O. Lammi, W. D. Miller, R. J. Preston, B. J. Zobel; *Associate Professors:* D. A. Adams, P. D. Doerr, D. J. Frederick, J. D. Gregory, F. P. Hain, J. B. Jett Jr., S. Khorram, D. H. J. Steensen, R. J. Weir; *Adjunct Associate Professors:* R. Ballard, G. L. DeBarr, J. R. Jorgensen, R. W. Stonecypher, H. A. Thomas; *Assistant Professors:* H. L. Allen Jr., H. V. Amer-son, R. I. Bruck, L. E. Hinesley, J. G. Laarman, R. A. Lancia, R. Lea, S. E. McKeand, L. A. Morris, R. A. Powell; *Assistant Professor (USFS):* J. E. de Steiguer; *Adjunct Assistant Professors:* J. A. Barker, M. S. Greenwood, R. B. McCullough, H. D. Smith; *Research Associate:* W. S. Dvorak

The Department of Forestry offers graduate work leading to the degrees of Master of Forestry, Master of Science and Doctor of Philosophy.

*These courses are designed to be audited and credits do not apply toward advanced degrees.

The Master of Forestry is a professional degree designed for students interested in the advanced applications of the principles of one of the fields in forestry. The course program emphasizes professional specialization; a thesis is not required. Two options are available, one involving at least 30 hours of course work plus a written report and the other at least 36 hours of course work.

The Master of Science degree requires the student to become broadly educated in the scholarly disciplines in the field of forestry. Independent research and a thesis are required for this degree.

The Doctor of Philosophy degree is available to students who demonstrate high intellectual capacity and the ability to conduct original research and scholarly work at the highest levels.

Students with a bachelor's degree in forestry may complete either of the master's programs in two academic years or less, provided they have met the undergraduate curriculum requirements in mathematics and the biological, physical and social sciences. Candidates who do not hold an undergraduate degree in forestry usually are required to extend their programs. Such programs usually take three years and may include attendance at undergraduate summer camp as a requirement.

All applicants must take the Graduate Record Aptitude Examination and submit scores as a part of their application.

The Department of Forestry offers instruction and graduate work in all of the major areas of forestry. Particular emphasis is placed upon forest genetics and tree breeding, forest soils and fertilization, silviculture and management of southern forests, forest economics, remote sensing, watershed management, mensuration, wildlife habitat management and resource management, planning and administration. Joint and associate faculty appointments with other departments provide exceptional opportunities for graduate studies in the forestry-related aspects of biometry, botany, ecology, economics and business, engineering, entomology, genetics, horticulture, hydrology, landscape architecture, plant pathology, soil science and wildlife science.

The department is housed in Biltmore Hall. Facilities for forest biological research include a phytotron, greenhouses and a small experimental nursery. The experimental and production forests of the school total more than 80,000 acres. The Hofmann Forest on the coastal plain, the Goodwin Forest at the edge of the sandhills and the Schenck, Hope Valley and Hill Forests in the Piedmont provide a variety of forest types and problems in the management of timber, water, wildlife and recreational resources. The Hill and Schenck Forests include natural areas, excluded from normal management operations, for the study of forest ecology.

The department has close working relations, through five cooperative programs of research and development (Tree Improvement, Hardwood Research, Forest Fertilization, Forest Engineering Equipment Development and Central American and Mexico Coniferous Resources) and the Southern Forest Research Center, with public agencies and the forest industries of the southeastern United States. In addition, many research programs are conducted on forest industry lands in the southeast.

For information concerning forestry graduate programs write: Graduate Administrator, Department of Forestry, P. O. Box 5488, North Carolina State University, Raleigh, N. C. 27650.

SELECTED ADVANCED UNDERGRADUATE COURSES

FOR 401 Forest Hydrology and Watershed Management. *Preq.: SSC 200. 4(3-3) F.*

FOR 405 Forest Management. *Preqs.: FOR 304, 319, ST 312, Summer Camp. 4(2-4) F.*

FOR 406 Forest Inventory, Analysis and Planning. *Preqs.: FOR 273, 353, 405, ST 312, Summer Camp. 4(0-16) S.*

FOR 411 Forest Tree Improvement. *Preq.: Jr. or sr. standing in FOR. 3(3-0) S.*

FOR (WPS) 423 Mechanization of Silvicultural Operations. *Preqs.: MA 113, MA 114, PY 221, jr. standing. 3(2-3) F.*

FOR 472 Renewable Resource Policy and Management. *Preqs.: A basic course in biology and economics; jr. standing. 4(3-3) S.*

FOR 491 Senior Problems in Forestry. *Preq.: Consent of department. 1-6. Credits Arranged.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

FOR 511 Tree Improvement Research Techniques. *Preq.: FOR 411 or GN 411. 3(1-4) Alt. S.* Research methods involved in forest tree breeding and genetics programs. Emphasis is placed on laboratory, greenhouse and field research techniques. Summary and presentation of research results are also stressed. Jett, Zobel

FOR 512 Forest Economics. *Preq.: Basic course in economics. 3(3-0) S.* Economics and social value of forests; supply of and demands for forest products; land use; forestry as a private and a public enterprise; economics of the forest industries. Holley, Laarman

FOR (PP) 518 Advanced Forest Pathology. *3(3-0) Alt. F.* (See plant pathology.)

FOR (PA) 522 Natural Resources Policy and Administration. *3(3-0) S.* (See political science and public administration.)

FOR (ENT) 565 Advanced Forest Entomology. *3(2-2) S.* (See entomology.)

FOR 571 Advanced Topics in Growth and Yield. *Preqs.: FOR 272, ST 312. 3(3-0) S.* Development and application of site index, volume and forest yield models. Primary emphasis is on underlying biological and mensurational assumptions and their impact on application. Hafley

FOR 572 Public Forest and Renewable Resource Issues. *3(3-0) S.* Current topics in public resource management policy. Special attention is directed to forest resources policies and state and federal management and regulatory programs affecting the use of renewable resources. The role of professional foresters and related specialists is stressed. Cooper

FOR (UNI) 584 The Practice of Environmental Impact Assessment. *4(0-8) F.* Students (in teams) inventory natural resources in a large watershed, predict development at year 2000, analyze impact upon the natural resource base and compile results as an environmental impact assessment. Techniques include map and aerial photo interpretation, timber and wildlife habitat inventory, erosion estimation, curve fitting, technical writing, computer modeling and project organization and management. Adams

FOR (FW) 585 Advanced Wildlife Habitat Management. *Preqs.: ZO (FW) 553 and ZO (FW) 554. 3(2-3) Alt. S.* Assessing and modeling habitat capability for wildlife species are discussed and evaluated. Students will develop models of habitat requirements for wildlife species and will integrate the models into wildlife management plans. Laboratory exercises include manipulation of habitat management computer packages and development of a wildlife management plan using computer cartographic techniques. Lancia

FOR 591 Forestry Problems. *Preq.: Advanced undergrad. or grad. standing. Credits Arranged. F,S,Sum.* Assigned or selected problems in the field of silviculture, harvesting operations, lumber manufacturing, policy, wood science, pulp and paper science, wood chemistry or forest management. Graduate Staff

FOR 599 Methods of Research in Forestry. *Preq.: Advanced undergrad. or grad. standing. Credits Arranged. F,S,Sum.* Research procedures, problem analysis, working plan preparation, interpretation and presentation of results; evaluation of selected studies by forest research organizations; techniques and constraints in the use of sample plots. Graduate Staff

FOR GRADUATES ONLY

FOR 601 Advanced Hydrology. *Preqs.: FOR 401, ST 512. 3(3-0) Alt. S.* The physical concepts of water movement through the hydrologic cycle and interactions with ecosystem components are discussed. Mathematical approaches to characterizing and quantifying hydrologic processes are derived and applied to problem solutions. Experimental design and statistics needed for collecting and analyzing hydrologic data are discussed and utilized. Development and use of simulation models are considered. Gregory

FOR (GN) 611 Forest Genetics. *Preq.: GN 411 or CI. 3(3-0) S.* Application of genetic principles to silviculture, management and wood utilization. Emphasis is on variation in wild populations, the bases for selection of desirable qualities and fundamentals of controlled breeding. Saylor, Zobel

FOR (GN) 612 Advanced Topics in Quantitative Genetics. *Preqs.: GN (FOR) 611, GN (ST) 626 or GN (ANS) 603 or CI. 3(3-0) Alt. F.* Advanced topics in statistics and population genetics pertinent to current research problems in genetics with special applications to forestry. Basic statistical and genetic theory is reviewed as bases for intensive study of selection theory and experimental and mating design evaluation. The genetics of natural populations are studied for evolutionary interest as well as for their implications to breeding theory. Namkoong

FOR 613 Special Topics in Silviculture. *Preq.: One course in silviculture or CI. 3(2-1) F.* Critical examination of selected topics, with special emphasis on concepts and phenomena which distinguish forests from other biotic communities and silviculture from other fields of applied biology. Frederick

FOR 614 Advanced Topics in Administration of Forest Resources. *Preq.: FOR 613 or CI. 3(3-0) S.* The state-of-the-art practices for administering commercial forest lands are explicitly detailed for advanced forestry graduate students. The economics of intensive and extensive management, the effect of management policies on timber yields and the financial stability of the forest industry are set forth, using governmental and industrial perspectives. Manuscripts suitable for publication will comprise 25% of the grade. Kellison, Lea

FOR (PA) 620 Environmental Administration. *3(3-0) S.* (See political science and public administration.)

FOR (SSC) 673 Advanced Forest Soils. *Preqs.: Two of SSC 511, SSC 522, SSC 532, SSC 551, 3(2-3) Alt. S.* An advanced consideration of the unique properties of forest soils and their relationships to the productivity and manageability of forest sites. The processes and dynamics of the nutrient cycle in forest ecosystems are covered in depth and used as a basis for understanding the impacts of silvicultural practices on forest site values. Individual field/laboratory projects are required. Allen

FOR 689 Seminar in Forest Research. *Preq.: Grad. standing. 1(1-0) F.* Philosophy and objectives of scientific research and the steps in the research process. Basic and applied research, inductive and deductive reasoning and the need for hypothesis development and testing as a basis for scientific research. Special emphasis on the preparation of study plans, graduate theses, published articles and technical presentations.

de Steiguer, Graduate Staff

FOR 691 Graduate Seminar. *Preq.: Grad. standing. 1(1-0) F,S.* Presentation and discussion of progress reports on research, special problems and outstanding publications in forestry and related fields. Cooper

FOR 692 Advanced Forest Management Problems. *Preq.: Grad. standing. Credits Arranged. F,S,Sum.* Directed studies in forest management. Graduate Staff

FOR 699 Problems and Research. *Preq.: Grad. standing. Credits Arranged. F,S,Sum.* Specific forestry problems that will furnish material for a thesis.

Graduate Staff

Genetics

GRADUATE FACULTY

Professor J. G. Scandalios, Head

Professors: D. S. Grosch, W. D. Hanson, W. E. Kloos, C. S. Levings III, D. F. Matzinger, R. H. Moll, H. E. Schaffer, A. C. Triantaphyllou; *Professor (USDA):* C. W. Stuber; *Professor (USFS):* G. Namkoong; *Professors Emeriti:* C. H. Bostian, T. J. Mann, L. E. Mettler, S. G. Stephens; *Associate Professors:* G. C. Bewley, C. C. Laurie-Ahlberg, W. H. McKenzie, R. R. Sederoff, S. L. Spiker; *Assistant Professors:* S. E. Curtis, T. H. Emigh

ASSOCIATE MEMBERS OF THE DEPARTMENT

Professors: J. L. Apple, F. B. Armstrong, C. C. Cockerham, E. J. Eisen, D. A. Emery, E. W. Glazener, M. M. Goodman, F. L. Haynes Jr., J. E. Legates, B. T. McDaniel, T. O. Perry, L. L. Phillips, J. O. Rawlings, O. W. Robison, L. C. Saylor, D. H. Timothy, B. S. Weir, E. A. Wernsman; *Professor (USDA):* J. F. Chaplin

Graduate study under the direction of the genetics faculty may enable the student to qualify for the Master of Science or the Doctor of Philosophy degrees. A candidate for the master's degree must acquire a thorough understanding of genetics and its relation to other biological disciplines and must present a thesis based upon one's own research. In addition to a comprehensive knowledge of his or her field, a candidate for the doctorate must demonstrate a capacity for independent investigation and scholarship in genetics.

At North Carolina State University there are no sharp divisions along departmental lines or between theoretical and applied aspects of genetics research. The members and associate members of the genetics faculty are located in six different departments of the Schools of Agriculture and Life Sciences, Forest Resources and Physical and Mathematical Sciences. They are studying a wide range of genetic problems and are utilizing not only the "classic" laboratory materials (maize, bacteria, *Drosophila*, *Habrobracon*, mice), but also farm animals and agricultural and forest plants of the region. A student has, therefore, a wide choice of research problems in any of the following fields: cytology and cytogenetics, microbial and biochemical genetics, molecular and developmental genetics, evolution and speciation, quantitative and population genetics and the application of genetics to breeding methodology.

Departmental offices and laboratories are located in Gardner Hall with greenhouse facilities adjacent to the building. A genetics garden for use in intensive research with plants and teaching functions is located three miles from the offices. The departmental staff and the associate faculty members in animal science, biochemistry, crop science, horticultural science, plant pathology, statistics and the School of Forest Resources are fortunate in being able to draw upon the extensive facilities of the North Carolina Agricultural Research Service.

SELECTED ADVANCED UNDERGRADUATE COURSES

GN 411 The Principles of Genetics. *Preqs.: BS 100, jr. standing. 3(3-0) F,S.*

GN 412 Elementary Genetics Laboratory. *Preq. or coreq.: GN 411. 1(0-2) F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

GN 504 Human Genetics. *Preq.: GN 301 or 411 or equivalent. 3(3-0) S.* The basic principles needed for an understanding of the genetics of man. Current knowledge and important areas of research in human genetics.
McKenzie, Schaffer

GN 505A,B,C,D Genetics I. *Preq.: GN 411. 1-4 F.* Principles presented as a series of five-week minicourses: GN 505A, molecular genetics; GN 505B, biochemical genetics; GN 505C, developmental genetics. The laboratory, GN 505D, involves experimental techniques in genetics and extends throughout the semester. Majors and minors must enroll for the entire course. Others may enroll for specific minicourses and attend the first lecture of semester for schedule.
Moll, Graduate Staff

GN 506A,B,C Genetics II. *Preq.: GN 411; Coreq.: ST 511. 1-3 S.* Principles presented as a series of five-week minicourses: GN 506A, population genetics; GN 506B, quantitative genetics; GN 506C, cytogenetics. Majors and minors must enroll for the entire series. Others may enroll for specific minicourses and attend the first lecture of the semester for schedule.
Moll, Graduate Staff

GN (ANS) 508 Genetics of Animal Improvement. *3(3-0) S.* (See animal science.)

GN (PO) 520 Poultry Breeding. *3(2-2) S.* (See poultry science.)

GN (ZO) 532 Biological Effects of Radiations. *Preq.: BS 100, or GN 301 or CI. 3(3-0) S.* Qualitative and quantitative effects of radiations (other than the visible spectrum) on

biological systems, to include both morphological and physiological aspects in a consideration of genetics, cytology, histology, morphogenesis and ecology. Grosch

GN (ZO) 540 Evolution. *Preq.: Nine credits in biological sciences. 3(3-0) S.* The nature of organic evolution is explored by examining the types of evidence that allow reconstruction of the history of life on earth as well as experimental and descriptive evidence regarding the mechanisms of genetic change in populations. Laurie-Ahlberg

GN (CS, HS) 541 Plant Breeding Methods. *3(3-0) F.* (See crop science.)

GN (CS, HS) 542 Plant Breeding Field Procedures. *2(0-4) Sum.* (See crop science.)

GN (CS) 545 Origin and Evolution of Cultivated Plants. *2(2-0) S.* (See crop science.)

GN 555 Population Genetics. *Preqs.: GN 506A, MA 102. 3(3-0) Alt. S.* Theoretical population genetics and its relationship to natural and experimental populations. Topics include: single locus and multilocus systems, history of a gene in a population, diffusion approximations, suitability of models to natural and experimental populations. (Offered S 1984 and alt. years.) Emigh

GN 560 Molecular Genetics. *Preqs.: GN 411; BCH 451. 3(3-0) F.* A discussion of the structure and function of the genetic material at a molecular level. Both prokaryotic and eukaryotic systems will be considered. The aim will be to describe genetics in terms of chemical principles. Spiker

GN (BCH) 561 Biochemical and Microbial Genetics. *Preqs.: BCH 451 or 551, GN 411 or 505, MB 401 or equivalent. 3(3-0) S.* A study of the development of the fields of biochemical and microbial genetics, emphasizing both techniques and concepts currently used in molecular research. Includes lectures and discussions of current research publications. Armstrong

GN 567 Molecular Cytogenetics. *Preqs.: GN 505B; GN 505C; GN 506A or equivalent. 3(3-0) F.* A molecular-genetic analysis of the structure function and evolution of eukaryotic genomes. Current methodology and approaches will be discussed, including DNA sequence analysis, chromosomal proteins, specific repeated genes, transposable elements in eukaryotic systems, structure and evolution of organelle genomes and use of recombinant DNA techniques in studies of chromosome structure. (Offered 1985-86 and alt. years.) Sederoff

FOR GRADUATES ONLY

GN (ANS) 603 Population Genetics in Animal Improvement. *3(3-0) F.* (See animal science.)

GN (FOR) 611 Forest Genetics. *3(3-0) S.* (See forestry.)

GN (FOR) 612 Advanced Topics in Quantitative Genetics. *3(3-0) F.* (See forestry.)

GN (CS, HS) 613 Plant Breeding Theory. *3(3-0) S.* (See crop science.)

GN (ST) 626 Statistical Concepts in Genetics. *3(3-0) S.* (See statistics.)

GN 633 Physiological Genetics. *Preq.: GN 505 or equivalent. 3(3-0) S.* Recent advances in physiological genetics. Attention will be directed to literature on the nature and action of genes, and to the interaction of heredity and environment in the expression of characteristics of higher organisms. Grosch

GN 641 Colloquium in Genetics. *Preqs.: Grad. standing; CI. 2(2-0) F,S.* Informal group discussion of prepared topics assigned by the instructor. Graduate Staff

GN 650 Developmental Genetics. *Preqs.: GN 411 or GN 505C and GN 506A. 3(3-0) F.* The action and regulation of genes and gene-products in development and differentiation. Examples will be taken from microorganisms, plants and animals. Emphasis will be placed on molecular and biochemical aspects of mechanisms controlling gene expression in eukaryotic cell differentiation. (Offered 1985-86 and alt. years.) Curtis

GN 651 Somatic Cell Genetics. *Preqs.: GN 505B and GN 506A; BCH 451. 3(3-0) S.* Discussion of the use of non-germ line cells for the genetic analysis of eukaryotic organisms. Plant, animal and fungal systems will be considered. Topics include: mutagenesis, selection, cell fusion, parasexual cycles, cloning, genetic engineering and regeneration of whole organisms. (Offered 1984-85 and alt. years.) Graduate Staff

GN 666 Laboratory in Molecular Genetics. *Preqs.: GN 505B, 505C, 506A or equivalent and CI. 4(2-6) Alt. S.* A laboratory course in modern techniques of molecular genetics for advanced students. Techniques will include *in situ* hybridization, recombinant DNA methodology, and DNA sequencing. Enrollment is limited to 10 students. Applications for a place in the course may be obtained from the department. (Offered S 1985 and alt. years.) Sederoff

GN 691 Seminar. *Preq.: Grad. standing. 1(1-0) F,S.* Scandalios

GN 694 Selected Topics in Cytogenetics. *Preqs.: GN 506 or CI. 2(2-0) F,S.* Readings and discussions of original cytogenetic literature. Chromosome replication, DNA redundancy, heterochromatin, models of crossing over and somatic cell genetics are some of the areas included. Topics of special interest to class members will also be covered. Gerstel

GN 695 Special Problems in Genetics. *Preqs.: Advanced grad. standing, CI. 1-3 F,S.* Special topics designed for additional experience and research training. Graduate Staff

GN 699 Research. *Preqs.: Grad. standing, permission of adviser. Credits Arranged.* Original research related to the student's thesis problem. A maximum of six credits for the master's degree; by arrangement for the doctorate. Graduate Staff

Graduate School Registrations (GR)

For information regarding these registrations, see Special Registration and Fees.

History

GRADUATE FACULTY

Professor B. F. Beers, Head

Professors: W. H. Beezley, C. H. Carlton, M. S. Downs, W. C. Harris, J. P. Hobbs—*Assistant Head of the Department,* D. E. King, J. M. Riddle, R. H. Sack, S. Suval, E. D. Sylla, B. W. Wishy; *Professors Emeriti:* M. L. Brown Jr., R. W. Greenlaw, M. E. Wheeler; *Associate Professors:* J. R. Banker, A. J. LaVopa, L. O. McMurry, J. A. Mulholland, G. D. Newby; *Associate Professor Emeritus:* R. N. Elliott; *Assistant Professors:* J. R. Barrett, J. E. Crisp, D. P. Gilmartin, W. A. Jackson

III, G. W. O'Brien, J. K. Ocko, S. T. Parker, R. W. Slatta, J. D. Smith, G. D. Surh, K. P. Vickery, K. S. Vincent; *Adjunct Assistant Professors*: N. B. Ketchiff, D. J. Olson, W. S. Price Jr.

ASSOCIATE MEMBER OF THE DEPARTMENT

Assistant Professor: J. C. Bonham

The history department offers a program leading to the Master of Arts degree in history. Although no specific courses are stipulated for admission to the program, preference will be given to those students with at least 18 hours in history and a total of 30 hours in the social sciences. Candidates are expected to have taken the aptitude portion of the Graduate Record Examination, or if admitted provisionally, must do so before the end of their first semester. Candidates are requested to include a brief statement of their objective in entering the program along with their application.

Normally a degree candidate will concentrate work in either European or American history with the required total of 30 hours being made up of nine to twelve hours of course work at the 500 level or above; six hours of research seminar (600 level); up to six hours of research and preparation of thesis (600 level); and six to nine hours of course work in a field related to the candidate's area of concentration (500 or 600 level). Under special circumstances a candidate may be permitted to include a 400-level course (see undergraduate catalog for descriptions) in his or her program if it has particular relevance to one's program objectives.

Master's candidates may incorporate into their programs course work enhancing their vocational opportunities. Social studies teachers may be awarded G certification through completion of a degree with a major in history and a minor in education. For those interested in the fields of archives administration, records management, museology and historical preservation, the department offers in cooperation with the North Carolina Department of Archives and History a number of courses which prepare individuals for a professional career in a public historical agency. Those interested should write to the Director of Graduate Studies, Department of History, for further details.

One fellowship and two teaching assistantships are now offered. Inquiry should be addressed to the department head, 161 Harrelson Hall.

North Carolina State University is a member of the Folger Institute of Renaissance and Eighteenth-Century Studies, a unique collaborative enterprise sponsored by the Folger Shakespeare Library in Washington, D.C., and twenty universities in the Middle Atlantic region. Each year the Institute offers an interdisciplinary program in the humanities—seminars, workshops, symposia, colloquia and lectures. Admission is open to faculty and students of North Carolina State University, and a limited number of fellowships are available through the Campus Folger Institute Committee.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

NOTE: Prerequisite: (500 level) Six hours of advanced history or equivalent.

HI 509 The High Middle Ages. *Credit in both HI 409 and HI 509 is not allowed. 3(3-0).* An analysis of various aspects of medieval culture for the period 936-1250. Selected topics will be examined using source readings in such subjects as the revival of the Roman Empire, monastic and papal reform, the rise of universities, the evolution of representative bodies, the Gothic style, troubadour and goliardic poetry, scholasticism and the revival of Roman law. Riddle

HI 515 Revolutionary Europe. *Credit in both HI 415 and HI 515 is not allowed. 3(3-0).* A broadly based analysis of Europe's first revolutionary era. Topics covered are the Enlightenment and its impact, the causes and character of the Revolution in France and the impact of these events in France and Europe. Graduate Staff

HI 518 Fascism in Germany and Italy, 1919-45. *Credit in both HI 418 and HI 518 is not allowed. 3(3-0).* Hitler and Mussolini: two aspects of European fascism. Suval

HI 528 England in the Age of the American Revolution. *3(3-0).* An intensive study of English political, religious, economic, social and imperial ideas and institutions between 1763 and 1783 with special emphasis on how these affected and were affected by the War of the American Revolution. Downs

HI 539 History of the Soviet Union. *Credit in both HI 439 and HI 539 is not allowed. 3(3-0).* History of the Soviet Union from the revolutions of 1917 to the present, emphasizing political, economic and cultural developments that have molded the Soviet state and society. Attention is also given to foreign policy with emphasis on the position of the Soviet Union in the world since 1945. Surh

HI 546 Reconstruction of the American Union. *Credit in both HI 446 and HI 546 is not allowed. 3(3-0).* A study of the period of sectional strife, war and reconstruction, including a close examination of the sectional polarization of the 1850s, the impact of the war on both northern and southern societies and the trauma of reconstructing the Union. Harris

HI 554 History of U. S. Foreign Relations, 1900-Present. *Credit in both HI 454 and HI 554 is not allowed. 3(3-0).* American diplomatic history since 1900; the expansion of American economic and cultural relations; the evolution of the American foreign policy bureaucracy; and the historical forces and personalities that shaped American relations with other nations. Beers

HI 557 U. S. Social History Methods. *Credit in both HI 457 and HI 557 is not allowed. 3(3-0).* Introduction to U. S. social history. Survey of methodologies, quantification, social science theory, comparative analysis, with application to in-depth investigation of selected themes, including demography, class, ethnicity, labor, race and sex. Barrett, O'Brien

HI 565 The History of Urban Life in the U.S., 1607-1865. *Credit in both HI 465 and HI 565 is not allowed. 3(3-0).* The historical background of today's urban problems. King

HI 566 The History of Urban Life in the U.S., 1865-Present. *Credit in both HI 466 and HI 566 is not allowed. 3(3-0).* The historical background of today's urban problems. King

HI 569 Latin American Revolutions in the Twentieth Century. *Credit in both HI 469 and HI 569 is not allowed. 3(3-0).* The varieties of revolutionary changes in twentieth-century Latin American revolutions: Argentina, Bolivia, Peru, Cuba and Chile. Beezley, Slatta

HI 581 History of Life Sciences. *Credit in both HI 481 and HI 581 is not allowed. 3(3-0).* Surveys the major ideas, methods, institutions and individuals that have contributed to the biological sciences from antiquity to modern times and examines the connections between the life sciences and other aspects of culture, including the physical sciences, religious belief, medical practice and agriculture. Students in the History of Life Sciences will read original sources and historical monographs concerning those topics. Sylla

HI 585 Principles and Practice of Applied History. *Preqs.: Grad. standing; 6 hours of history or equivalent. Credit in both HI 485 and HI 585 is not allowed. 3(3-0).* An introduction to applications of history to public life and to the conservation and presentation of historical materials, with particular attention to conservation problems generated by modern technology. Topics include archives, records management, historical editing, museology, historical preservation, special forms of presentation like historic sites and audiovisual techniques and computer applications. Smith

HI 586 History and Principles of the Administration of Archives and Manuscripts. *Credit in both HI 486 and HI 586 is not allowed. 3(3-0).* Nature, importance and use of original manuscript resources; the history and evolution of written records and the institutions administering them; the principles and practices of archives administration. Olson

HI 587 Application of Principles of Administration of Archives and Manuscripts. *Preqs.: Six hours of advanced history and HI 586. Credit in both HI 487 and HI 587 is not allowed. 3(3-0).* Internship training in the application of the principles and practices of archival management as developed in HI 586. Olson

HI 598 Special Topics in History. 1-6. An investigation of topics of particular interest to advanced students under the direction of faculty members on a tutorial basis. Graduate Staff

FOR GRADUATES ONLY

NOTE: Prerequisite: (600 level) Six hours of advanced history or equivalent.

HI 601 Historiography and Historical Method. 3(3-0). A study of the major steps in the development of historical investigation and writing from classical times to the present, as well as an analysis of the elements of good historical research and writing with some discussion of methodology used by the contemporary scholarly historian. Graduate Staff

HI 602 Seminar in American History. 3(3-0). A small research seminar on special topics in American history. Graduate Staff

HI 604 Seminar in European History. 3(3-0). A small research seminar on special topics in European history. Graduate Staff

HI 688 Iconographic and Other Archival Materials. *Preq.: HI 485/585. 3(2-2).* Introduction to archival materials. Examination of and practice in the storage and care of paper and books, prints, engravings and maps. Films, transparencies, negatives, magnetic tapes and phonorecords. Emphasis on preventive conservation. Smith

HI 689 Documentary Editing. *Preq.: HI 485/585. 3(3-0).* An introduction to the field of documentary editing. Development of historical editing and the rules of literal, expanded and modern editorial method. Special documentary/papers projects. Smith

HI 699 Research in History. *Credits Arranged. 1-6.* Individual research under graduate thesis supervisor. Graduate Staff

Horticultural Science

GRADUATE FACULTY

Professor A. A. De Hertogh, Head

Professor F. L. Haynes, Graduate Coordinator

Professors: W. E. Ballinger, R. T. Konsler, R. A. Larson, J. W. Love, C. M. Mainland, C. H. Miller, T. J. Monaco, P. V. Nelson, D. M. Pharr, J. C. Raulston, D. C. Sanders, W. A. Skroch, L. G. Wilson; *Adjunct Professor:* R. L. Sawyer; *Professors Emeriti:* F. D. Cochran, J. M. Jenkins, D. T. Pope; *Associate Professors:* J. R. Ballington, T. E. Bilderback, F. A. Blazich, V. P. Bonaminio, W. W. Collins, W. C. Fonteno, R. G. Gardner, W. R. Henderson, C. R. Unrath, E. Young; *Associate Professor (USDA):* L. K. Hammett; *Associate Professors Emeriti:* T. F. Cannon, D. C. Zeiger; *Assistant Professors:* S. M. Blankenship, A. R. Bonanno, P. R. Fantz, L. E. Hinesley, W. E. Hooker, W. J. Lamont Jr., M. M. Peet, K. B. Perry, E. B. Poling, T. C. Wehner, D. J. Werner

ASSOCIATE MEMBERS OF THE DEPARTMENT

Professors: R. Aycock, R. J. Downs, R. H. Moll, R. L. Mott; *Associate Professor:* D. E. Carroll

Graduate study under the direction of the horticultural science faculty may lead to the Master of Science and the Doctor of Philosophy degrees. Areas of study include plant physiology, plant breeding and genetics, post-harvest physiology, plant nutrition, tissue culture, growth regulators and weed science. The Master of Agriculture, a professional degree, can be earned by substituting additional course work for research requirements of graduate study.

Facilities for graduate studies include a 30,000 square-foot greenhouse (21 sections, each with separately controlled light and temperature); the University Phytotron (available for controlled environmental studies on horticultural crops); 19 well-equipped laboratories (chromatography, seed handling and storage, cytological/anatomical, radioisotope, tissue culture, post-harvest and nutritional studies). There are 14 controlled temperature storage rooms; an extensive collection of plant materials, both living (NCSU Arboretum) and preserved; and a variety of climates and soils from coast to mountains in North Carolina on 15 outlying research stations.

Opportunities for employment after graduate study include teaching and research faculty positions in state and private universities; research and regulatory positions with the United States Department of Agriculture, both foreign and domestic; extension specialists and county agents; research, production and promotional work with agri-business concerned with production of horticultural crops or services to horticultural industries.

Graduate teaching and research assistantships (commercial, Agricultural Foundation or Research Service) for promising students are available. Students are encouraged to apply for assistantships at least six months prior to the anticipated enrollment date.

SELECTED ADVANCED UNDERGRADUATE COURSES

HS 400 Residential Landscaping. *Preqs.: DF 234; HS 211, 212, 342; HS 416 or DN 433; SSC 200, DN 257, 430. 6(0-9) F,S.*

HS 411 Nursery Management. *Preqs.: BS 100, SSC 200. 3(2-3) F.*

HS 416 Principles of Ornamental Planting Design. *Preqs.: HS 211, HS 212, HS 342, SSC 200, DN 234. 3(2-4) F.*

HS 421 Tree Fruit Production. *Preqs.: BS 100 or BO 200, SSC 200, HS 201. 3(2-3) F.*

HS 422 Small Fruit Production. *Preqs.: BS 100 or BO 200, SSC 200, HS 201. 3(2-3) S. Alt. yrs.*

HS 431 Vegetable Production I. *Preqs.: BS 100, SSC 200. 4(3-3) F.*

HS 440 Greenhouse Management. *Preqs.: BS 100, SSC 200. 3(2-3) F.*

HS 441 Floriculture I. *Preqs.: BS 100, SSC 200. 3(2-3) F.*

HS 442 Floriculture II. *Preqs.: BS 100, SSC 200. 3(2-3) S.*

HS 471 Arboriculture. *Preqs.: BS 100, SSC 200. 3(2-3) S.*

HS 491 Horticultural Science Seminar. *Preq.: Jr./sr. standing. in horticultural science. 1(1-0) F.*

HS 495 Special Topics in Horticultural Science. *1-6 F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

HS (CS) 514 Principles and Methods in Weed Science. *Preq.: CS 414 or equivalent. 3(2-2) S.* Studies on the losses caused by weeds, the ecology of weeds, biological control, basic concepts of weed management, herbicide-crop relationships and herbicide development. Introduction to greenhouse and bioassay techniques used in herbicide work and to field research techniques supplemented by laboratory and field exercises. Monaco

HS (FS) 521 Food Preservation. *3(2-3) F.* (See food science.)

HS 531 Physiology of Landscape Plants. *Preq.: BO 421 or CI. 3(2-3) S.* A course designed to cover relationships of plants to landscape environments. Study of plant function, basic climatology and plant physiological principles involved in the selection, utilization and maintenance of physical landscape environments in exterior and interior ornamental landscape plantings. Raulston

HS 532 Vegetable Crop Physiology. *Preqs.: BO 421, HS 431, SSC 341. 2(2-0) F. Even yrs.* Physiological aspects of field and greenhouse vegetable production: germination, photoperiod, nutrition, growth regulations, fruit quality, physiological disorders, source-sink interactions, environmental physiology and physiological aspects of plant protection. Emphasis on current areas of research and the physiological implications of new production techniques. (Offered S 1985 and alt. years.)

HS (CS, GN) 541 Plant Breeding Methods. *3(3-0) F.*

HS (CS, GN) 542 Plant Breeding Field Procedures. *2(0-4) Sum.* (See crop science.)

HS 552 Growth of Horticultural Plants. *Preq.: BO 421. 3(2-3) F.* Exercises in tissue culture principles and techniques as they relate to horticulture. Emphasis on endogenous controls of plant growth and the role of growth regulating compounds in horticultural research and production. Graduate Staff

HS (FS) 562 Postharvest Physiology. *Preq.: BO 421. 3(3-0) S.* A study of chemical and physiological changes that occur during handling, transportation and storage which affect the quality of horticultural crops. Consideration will be given to preharvest and postharvest conditions which influence these changes. Graduate Staff

HS 595 Special Topics in Horticultural Science. *Preq.: CI. 1-6 F,S,Sum.* Investigation of special theoretical problems at the 500 level in horticultural science not related to a thesis problem; new 500-level courses during the developmental phase. Graduate Staff

HS 599 Research Principles. *Preq.: CI. Credits Arranged, Maximum 6.* Investigation of a problem in horticulture under the direction of the instructor. The students obtain practice in experimental techniques and procedures, critical review of literature and scientific writing. The problem may last one or two semesters. Credits will be determined by the nature of the problem, not to exceed a total of three hours for any one problem. A written report and final oral exam required for completion of course. Graduate Staff

FOR GRADUATES ONLY

HS (CS, GN) 613 Plant Breeding Theory. *3(3-0) S.* (See crop science.)

HS (CS, SSC) 614 Herbicide Behavior in Plants and Soils. *3(3-0) F.* (See crop science.)

HS 621 Methods and Evaluation of Horticultural Research. *Preq.: Grad. standing. 3(3-0) F.* Study of necessary elements for a career in horticultural research including: background and philosophy of scientific research; survey of horticultural research history and current status; research design and evaluation; photographic techniques; technical writing including project proposals, administrative reports and publications; office and personnel management. Raulston

HS 622 Mineral Nutrition in Plants. *Preqs.: BO 551, 552. 3(2-3) S. Odd yrs.* A comprehensive study of the functional roles of nutrients essential to plant growth, their interrelationships and their mode of influence on quality indices of crops. Consideration of the complexity of mineral nutrition experimentation and evaluation of results. A detailed look at the establishment and application of foliar analysis, foliar fertilization and slow-release fertilizers. A general view of the nutrient uptake process in plants. (Offered 1984-85 and alt. years.) Nelson

HS 691 Seminar. *Preq.: Grad. standing. 1(1-0) F,S.* Required of all horticultural science graduate students. Presentation of scientific articles and special lectures. Students will be required to present one or more papers. Graduate Staff

HS 695 Graduate Topics in Horticultural Science. *Preq.: CI. 1-6 F,S,Sum.* Investigation of theoretical problems at the 600 level in horticultural science not related to a thesis problem; new 600-level courses during the development phase. Graduate Staff

HS 699 Research. *Preqs.: Grad. standing in HS, consent of advisory committee chairman. Credits Arranged.* A maximum of six credits is allowed toward the Master of Science degree; no limitation on credits in doctoral program. Original research on specific problems in fruit, vegetable and ornamental crops. Graduate Staff

Industrial and Technical Education

For a listing of graduate faculty and program information, see industrial and technical education in the education section.

Industrial Arts Education

For a listing of graduate faculty and program information, see industrial arts education in the education section.

Industrial Engineering

GRADUATE FACULTY

Professor T. J. Hodgson, *Head*

Professors: M. A. Ayoub, R. H. Bernhard—*Graduate Administrator*, J. R. Canada, S. E. Elmaghraby, R. G. Pearson, A. L. Prak, W. A. Smith Jr., S. Stidham Jr.; *Adjunct Professor:* E. R. MacCormac; *Professors Emeriti:* C. A. Anderson, R. G. Carson Jr., R. W. Llewellyn; *Associate Professors:* R. E. Alvarez, H. L. W. Nuttle; *Visiting Associate Professor:* H. Paul; *Adjunct Associate Professors:* D. C. Antonelli, R. L. Launer; *Associate Professor Emeritus:* J. J. Harder; *Assistant Professors:* H. Bao, M. G. Joost, J. E. Richards, E. T. Sanii; *Visiting Assistant Professor:* C. B. Oldham; *Adjunct Assistant Professor:* A. J. Barwick

Industrial engineering is concerned with solutions to problems relating to design and control of organizational systems, such as industrial and commercial corporations, government agencies and other institutions which provide goods or services for public consumption. Interests include the management of operations, planning and scheduling, manufacturing engineering, allocation of resources, dynamic system design, man-machine relationships and occupational safety and health.

The department offers the degrees of Master of Industrial Engineering, Master of Science in both industrial engineering and management and Doctor of Philosophy. The focal points of study are management systems, ergonomics and production systems. Typical minors are taken in statistics, economics and business, mathematics, psychology and other engineering disciplines.

The M.S. degree may be taken either with or without a thesis. The thesis work for the M.S. degree may account for as many as six semester hours. For the non-thesis option a formal written report, based upon scholarly project work, is required. No thesis is required for the M.I.E. degree. A departmental brochure which details the orientation and requirements for all degrees is available. No foreign language is required at the master's level and a foreign language is optional with the student's advisory committee at the doctoral level.

The University provides access to an outstanding mainframe computer facility at the Triangle Universities Computing Center (TUCC) through conveniently

located computer terminals. In addition, the Department of Industrial Engineering operates numerous microcomputers, minicomputers and a medium-scale computation facility. Facilities for ergonomics research are also excellent for the study of environmental factors, biomechanics and work physiology and human performance assessment.

SELECTED ADVANCED UNDERGRADUATE COURSES

IE 401 Stochastic Models in Industrial Engineering. *Preq.: An introductory course in probability and/or math statistics. 3(3-0) F,S.*

IE 402 Quantitative Methods & Optimization. *Preq.: IE 361. 3(3-0) F.*

IE 403 Quantitative Methods Practicum. *Preqs.: IE 361, IE 401. 3(1-2) S.*

IE 421 Information and Control Systems. *Preq.: IE 307. 3(3-0) F,S.*

IE 432 Methods Engineering. *Preq.: IE 352. 3(2-3) S.*

IE 452 Ergonomics. *Coreq.: IE 352. 3(2-2) F.*

IE 453 Facilities Design. *Preqs.: IE 351, 352. 3(2-2) F.*

IE 454 Modeling of Man-Machine Systems. *Preq.: IE 401. 3(2-1) S.*

IE 481 Engineering Economics (Mini). *Preqs.: Sr. standing and MA 201. Not for IE, CE, EO, and FMM undergraduates or anyone having received credit for IE 301, IE 311, or equivalent. 1(3-0) S.*

IE 482 Work Methods and Measurement (Mini). *Preqs.: Sr. standing and CI. Not for EO, IE and FMM undergraduates or anyone having received credit for IE 332 or equivalent. 1(3-0) F.*

IE 485 Manufacturing Engineering (Mini). *Preqs.: Sr. standing and CI. Not for IE and EO undergraduates or students who have taken MAT 400 or MAT 423. 1(3-0) F,S.*

IE 487 Information Systems (Mini). *Preqs.: Sr. standing and computer programming course. Not for IE or FMM undergraduates or other students having received credit for IE 307 or equivalent. 1(3-0) F.*

IE 488 Production and Inventory Control (Mini). *Preqs.: Sr. standing and CI. Not for IE and FMM undergraduates. 1(3-0) F.*

IE 489 Labor Relations for Engineers (Mini). *Preqs.: Sr. standing and CI. Industrial employment experience highly desirable (full time, co-op or summer). 1(3-0) F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

IE (MA, OR) 505 Mathematical Programming I. *Preq.: MA 405. 3(3-0) F,S.* A study of mathematical methods applied to problems of planning. Linear programming will be covered in detail. This course is intended for those who desire to study this subject in depth and detail. It provides a rigorous and complete development of the theoretical and computational aspects of this technique as well as a discussion of a number of applications.

Lee, Peterson

IE (OR) 509 Dynamic Programming. *Preqs.: MA 405, ST 421. 3(3-0) S.* An introduction to the theory and computational aspects of dynamic programming and its application to sequential decision problems. Elmaghraby, Nuttle

IE 511 Capital Investment Economic Analysis. *Preqs.: IE 311, ST 371. 3(3-0) F.* Analysis of economic merits of alternatives including interest and income tax considerations. Risk and sensitivity exploration techniques. Introduction to analytical techniques for multiple objectives or criteria. Use of mathematical programming and computers for capital budgeting. Bernhard, Canada

IE 512 Bayesian Decision Analysis for Engineers and Managers. *Preq.: ST 371 or ST 421. 3(3-0) F.* The Bayesian approach to decision making, with numerous applications in engineering and business. Expected value maximization, decision trees, Bayes' theorem, value of information, sequential procedures and optimal strategies. Axiomatic utility theory and controversies, utility of money, theoretical and empirical determination of utility functions and relationship to mean-variance analysis. Brief introduction to multi-attribute problems, time streams and group decisions. Bernhard, Canada

IE 515 Advanced Manufacturing Processes. *Preqs.: IE 351 and ECE 331 or equivalent. 3(3-0) F.* The course examines manufacturing processes which involve chemical, electrochemical, electrical, thermo-electric and non-conventional mechanical energy modes. Each process is investigated as to its underlying theory, state-of-the-art technology, interaction with the workpiece material, geometric capability and economics. Bao

IE 517 Computer-Aided Manufacturing. *Preqs.: IE 351 or equivalent and computer programming. 3(3-0) S.* This course is concerned with the integration of the elements of production processes into a Computer-Aided Manufacturing system (CAM). Students will generate programs for parts production in the APT language, for plotter verification and for 3-axis machining. The benefits of computer-aided design and graphics in designing products for CAM are stressed. Industry case examples of machining, assembly and continuous process operations are studied. Bao

IE 521 Management Decision and Control Systems. *Preqs.: IE 421, CSC 421 or equivalent. 3(3-0) S.* Planning and development of comprehensive computer-based information systems to support management decisions. Formal systems concepts; management information requirements. Management science and organizational behavior influences. Data bases and advanced system techniques and concepts. System evaluation and cost effectiveness. Smith

IE 522 Organizational Systems Dynamics. *Preqs.: ST 371, IE 421. 3(3-0) F.* A study of the behavior of large organizations as simulated on a large digital computer and driven by suitable exogenous inputs. Basic theory of feedback control of systems; methods of modeling for continuous simulation, including aspects of management policy. Projects cover study, modeling and simulation of industrial, business, political social organizations and systems; methods of changing system behavior by modifying parameters and model structure. Graduate Staff

IE 523 Production Planning, Scheduling and Inventory Control. *Preqs.: OR 501 and ST 515 or equivalents. 3(3-0) S.* An analysis of Production-Inventory systems. Discussion of commonly used planning and scheduling techniques. Introduction to the use of math modeling for solution of planning and scheduling problems. Interface with quality control and information systems. Alvarez, Nuttle

IE 525 Organizational Planning and Control. *Preq.: Three credit hours in operations management (such as EB 325, IE 308). 3(3-0) S.* Organization theory and systems approaches

to administrative functions. Human and social influences of management systems for planning and control of activity. Policy, structure and procedure related to industrial engineering activities. Effects of automation. (Offered in alt. years.) Pearson, Smith

IE (PSY) 540 Human Factors in Systems Design. *Preq.: IE (PSY) 338 or IE 452; Coreq.: ST 507 or 515. 3(3-0) S.* Introduction to problems of the systems development cycle, including man-machine function allocation, military specifications, display-control compatibility, the personnel sub-system concept and maintainability design. Detailed treatment is given to man as an information processing mechanism. Pearson

IE 541 Systems Safety Engineering. *Preqs.: IE 452, ST 371. 3(30) F, Sum.* Problems in occupational safety and health; preventive aspects involving product and work design and personnel selection. Consideration of the methods used in accident-injury study, including field investigation, experimental engineering and biomedical research, statistical studies and fault tree analysis. Managerial aspects of safety accountability. (Offered in alt. years.) Ayoub, Pearson

IE 542 Physiological Criteria in Work Measurement. *Preq.: Grad. status. 3(3-0) F.* Emphasis is placed on basic endocrine and autonomic nervous system anatomy and physiology; measures reflecting sympathetic nervous system activity; concepts applicable to work measurement studies including a discussion of arousal theory and the concept of autonomic balance; and survey of current literature on equipment design and use. (Offered in alt. years.) Ayoub

IE 544 Occupational Biomechanics. *Preq.: Grad. standing in engineering. 3(2-2) F.* General concepts and techniques of understanding the anatomical and physiological bases of human motion. Characteristics and limitations of human motor capabilities, body mechanics and use of biomedical instrumentation for monitoring and quantifying human performance. Applications of biomechanics in work, industry, rehabilitation, sports, space research and safety are also considered. (Offered in alt. years.) Ayoub

IE 547 Reliability and Quality Assurance. *Preq.: One of the following: IE 308, IE 371, ST 421 or ST 515. 3(3-0) S.* An introduction to basic concepts of reliability and quality assurance. Application of probability and statistics to estimation and control of quality and reliability of industrial processes. Control charts and acceptance sampling. Reliability estimation, life testing. Failure distributions and rates. Reliability of systems: series, parallel and monotone systems. Maintenance of systems. Redundancy optimization. Quality management in industrial systems. Alvarez, Prak, Stidham

IE 553 Materials Handling Systems. *Preq.: IE 453. 3(3-0) S.* Analysis, design, evaluation and implementation of materials handling systems. Principles, functions, equipment concepts and traditional approaches of materials handling. Impact of facilities design on materials handling and application of quantitative techniques to materials handling systems design. Description of factors and approaches to materials handling management and the criticality of properly designed and operated material flow systems. Graduate Staff

IE 556 Industrial Logistics. *Preq.: IE 453. 3(3-0) F.* Materials management, materials flow and physical distribution. Management of activities required to move raw materials, parts and finished inventory from vendors, within an enterprise and to customers. This course will cover the design and operation of effective industrial logistics systems. Graduate Staff

IE (OR) 561 Queues and Stochastic Service Systems. *Preq.: MA 421. 3(3-0) F.* General concepts of stochastic processes are introduced. Poisson processes, Markov processes and renewal theory are presented. These are then used in the analysis of queues, starting with a completely memoryless queue to one with general parameters. Applications to many engineering problems will be considered. Stidham

IE (CSC, CSE, ECE, OR) 562 Advanced Topics in Computer Simulation. *3(3-0) F.* (See computer studies.)

IE (MA, OR) 586 Network Flows. *Preq.: IE (OR, MA) 505 or equivalent. 3(2-2) S.* This course will study problems of flows in networks. These problems will include the determination of the shortest chain, maximal flow and minimal cost flow in networks. The relationship between network flows and linear programming will be developed as well as problems with nonlinear cost functions, multicommodity flows and the problem of network synthesis. (Offered in alt. years.)
Graduate Staff

IE 589 Special Topics in Industrial Engineering. *Preqs.: Grad. or sr. standing and CI. 1-4.* Exploration of emerging topics of interest to faculty and students. Generally used for the first offering of a new course, using conventional lecture format. Sometimes used for directed readings, problem sets and reports as required.
Graduate Staff

IE 591 Project Work. *Preq.: Grad. standing. 1-6 F,S,Sum.* Investigation and report on assigned problems requiring application of industrial engineering techniques.
Graduate Staff

IE (PSY) 593 Area Seminar in Ergonomics. *1(0-2) F.* (See psychology.)

FOR GRADUATES ONLY

IE 608 Linear Programming Applications. *Preq.: IE (MA, OR) 505 or EB 555. 3(3-0) S.* The application of linear programming to large problems of a practical nature; product mix, diet, scheduling and blending problems; problem generation, control of accuracy, report generation. Stress is laid on post-optimal studies, multiple-objective functions and right-hand sides; parametric programming on the right-hand side, the objective function, the rim and the interior. Decomposition of various types of problems will receive considerable attention with extensions into some nonlinear systems. (Offered in alt. years.)
Graduate Staff

IE 611 The Design of Production Systems. *Preqs.: IE (MA, OR) 505, OR 501. 3(3-0) F.* The study of production systems: the model, the criterion, decision making and optimization, levels of decision. The graphic representation of systems: signal flow graphs, activity analysis, networks of flow models. The machine assignment problem, scheduling and sequencing, line balancing location-allocation of new facilities. The use of computers in the design of production systems. (Offered in alt. years.)
Elmaghraby

IE 621 Advanced Problems in Management Systems Engineering. *Preq.: CI. 1-4 S.* Coverage of advanced techniques, current research and contemporary problems in analysis, design and operation of management systems. Varied topics will cover aspects of economic decision analysis, cost effectiveness, information flow, system performance evaluation and modern organization concepts.
Bernhard, Canada, Smith

IE 622 Inventory Control Methods II. *Preq.: IE 523. 3(3-0) F.* A continuation of IE 523; stochastic inventory systems of lot sized-reorder type; periodic review and single period models. Application of dynamic programming theory to deterministic and stochastic cases.
Nuttle

IE (PSY) 640 Skilled Operator Performance. *Preqs.: PSY 545, ST 507, or ST 515. 3(3-0) Alt. F.* Theories of the human operators are considered with regard to the classical problems of monitoring, vigilance and tracking. Factors such as biological rhythm, sleep loss, sensory restriction, environmental stress and time-sharing are considered as they interact with and determine overall systems efficiency.
Pearson

IE 641 Environmental Factors and Human Performance. *Preqs.: IE (PSY) 540 and IE 542 or other equivalent. 3(3-0) S.* Study of major problem areas, methodology, theory and experimental work in biotechnology; interaction among engineering, biological and behavioral factors in design for safety and survival; physiology and biomechanics of acceleration, deceleration and pressure altitude; consideration of operator effectiveness in submarine, extra-terrestrial, arctic and desert environments; techniques in evaluation of crash dynamics and pathology; closed-ecological systems. (Offered in alt. years.) Pearson

IE 651 Special Studies in Industrial Engineering. *Preq.: Grad. standing. Credits Arranged.* The purpose of this course is to allow individual students or small groups of students to undertake studies of special areas in industrial engineering which fit into their particular program and which may not be covered by an existing industrial engineering graduate level course. Problems may require individual research and initiative in the application of industrial engineering training to new areas or fields. Graduate Staff

IE (OR, MA) 692 Special Topics in Mathematical Programming. *Preq.: IE (MA, OR) 505. 3(3-0) F,S,Sum.* The study of special advanced topics in the area of mathematical programming. New techniques and current research in this area will be discussed. The faculty responsible for this course will select the areas to be covered during the semester according to their preference and interest. This course will not necessarily be taught by an individual faculty member but can, on occasion, be a joint effort of several faculty members from this university as well as visiting faculty from other institutions. To date, a course of Theory of Networks and another on Integer Programming have been offered under the umbrella of this course. It is anticipated that these two topics will be repeated in the future together with other topics. Graduate Staff

IE 693 Seminar in Applied Ergonomics. *Preqs.: IE (PSY) 540, ST 515. 1(0-2) S.* Discussion of contemporary issues involving the systems approach to accident prevention and injury control. History of safety research; federal health, industrial and military activities in safety, current centers of safety research and their activity. Ayoub, Pearson

IE 694 Advanced Problems in Ergonomics. *Preqs.: IE (PSY) 540, ST 515. 3(3-0) F.* Exploration in depth of a problem area of contemporary interest involving the man-machine-environment interface. Class discussion and analysis of research and theory, with special focus on the human factors aspects of systems design and operation. Ayoub, Pearson

IE 695 Seminar. *1(1-0) S.* Seminar discussion of industrial engineering problems for graduate students. Case analyses and reports. Graduate Staff

IE 699 Industrial Engineering Research. *Preq.: Grad. standing. Credits Arranged. F,S,Sum.* Graduate research in industrial engineering for thesis credit. Graduate Staff

International Development

Professor J. L. Apple, Coordinator

The degree of Master of Technology for International Development (MTID) gives an international orientation to the master's degree which is sought in any of the scientific, social and professional fields represented at this university. At a time when the world is moving inexorably toward greater interchange of people and increased commerce among nations, the MTID program provides specialized training for students who are interested in utilizing their skills in international activities, whether technical, consultative or administrative in nature.

The program of work requires the following:

- 1) A total of 36 semester credits, at least half of which must be in the relevant professional area. The remainder of the course work provides special orientation, sensitivity and understanding for work in a foreign culture. Among these "internationalizing" courses, 12 semester credits may be drawn from courses at the 300 or 400 levels with no more than six credits being taken from the 300 level.
- 2) A work experience of a minimum of 12 weeks in a foreign country and a substantial report on that field experience.
- 3) Conversational facility in one foreign language as determined by an oral examination.
- 4) A comprehensive written examination, which may be required at the discretion of the advisory committee.
- 5) Passage of a comprehensive oral examination conducted by the advisory committee.

The program of study is tailored to the student's individual needs rather than following a prescribed course. The relevant department assists in choosing a set of courses which provide grounding in the professional area, and the Office of International Programs assists in identifying appropriate "internationalizing" courses which satisfy the student's particular needs and interests.

The following exemplify MTID plans of study:

Example 1—Core Area: Animal Science

Courses in Animal Science

ANS 502	Reproductive Physiology of Vertebrates	3
ANS 508	Genetics of Animal Improvement	3
ANS 510	Advanced Livestock Management	3
ANS 520	Tropical Livestock Production	3
ANS 540	Ruminant Physiology and Metabolism	3
PO 524	Comparative Endocrinology	4
		<hr/> 19

"Internationalizing" Courses

EB 401	Economics Analysis for Nonmajors	3
HI 476	Leadership in Modern Africa	3
HI 498	Independent Study in History	3
PA 533	Global Problems and Policy	3
PS 431	International Law and Organization	3
SOC 652	Comparative Societies	3
		<hr/> 18
Total semester hours		37

Example 2—Core Area: Public Administration

Courses in Public Administration

PA 511	Public Administration	3
PA 516	Public Policy Analysis	3
PA 612	The Budgetary Process	3
PA 614	Seminar in Management Systems	3
PA 617	Seminar in Organization Theory	3
PA 621	Collective Negotiations in the Public Service	3
		18

“Internationalizing” Courses

EB 448	International Economics	3
HI 415	Revolutionary Europe	3
HI 554	History of U.S. Foreign Relations, 1900-Present	3
PS 641	Seminar in Comparative Politics	3
SOC 503	Contemporary Sociology	3
SOC 514	Developing Societies	3
		18

Total semester hours	36
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Recognition that the interdependence of nations and the free exchange of ideas and technology is vital to global survival is now commanding greater attention than at any other time in history. The MTID program is a sophisticated response that equips graduates with the social, philosophical and technical skills necessary for employment with national and international organizations (profit and non-profit), business firms and government agencies.

General requirements for admission to the MTID program include a Bachelor’s degree from an accredited college or university, a grade point average of 3.0 (“B”) in one’s undergraduate major and satisfactory performance on the Graduate Record Exam.

Landscape Architecture

GRADUATE FACULTY

Professor A. L. Sullivan, Program Director

Professors: C. E. McKinney, T. O. Perry, R. E. Stipe, R. R. Wilkinson; Professor Emeritus: E. G. Thurlow; Associate Professors: A. R. Abbate, L. L. Jewell, R. C. Moore, J. C. Raulston, D. Wood; Assistant Professor: D. W. Dalton; Lecturer: R. M. Leary; Visiting Lecturer: R. S. Altman

The landscape architecture program offers the graduate professional degree, Master of Landscape Architecture. In addition to acquiring basic skills necessary to professional practice, the student may concentrate on site planning, environmental management or community design.

The student will select one of two programs depending on undergraduate preparation. Those students possessing a Bachelor of Landscape Architecture degree from a program accredited by the American Society of Landscape Architects are required to take 36 semester credits of course and studio work. Three semesters of residence is normal.

Students with undergraduate majors in landscape architecture or fields other than landscape architecture are encouraged to apply for the Master of Landscape Architecture as a first professional degree. This program, accredited by the American Society of Landscape Architects, prepares the student with basic skills of site planning, materials and construction, plants and design, graphic communications and history of landscape architecture. Depending on previous work, this accredited program will require two to three years of study.

A graduate advisory committee constructs an individualized curriculum for each student. Because the curriculum is individually tailored, course requirements vary, but range upward from a minimum of 48 credits for students with previous work in landscape architecture to an average of around 72 for students with no prior preparation in landscape architecture.

A graduate core including social factors analysis, communications and community design policy and project planning is required of students in both programs. Also required is a supporting area which may include theories and techniques from such disciplines as anthropology, soil science or ecology applied to problems in landscape architecture.

Both programs require a preliminary oral examination on basic theory and skills, a final project demonstrating individual achievement in the landscape design process and a final comprehensive oral examination. Each of these steps is administered by the student's graduate advisory committee.

The faculty is the greatest strength of the MLA programs. It combines experience in geography, planning, ecology, architecture, anthropology, horticulture, forestry, soils, law and public administration with landscape design. A large number of landscape architects who practice in the local area provide practical insights and internships.

Excellent facilities support the MLA program. The library, the environmental simulation laboratory, the photographic and printing center and the machine shops are well equipped and permanently staffed. Brooks Hall houses the School of Design which is comprised of the landscape architecture, architecture and product design programs. A 37,000 square foot addition encloses courtyards rich in trees and flowering shrubs.

Landscape architecture is available as a support area to other graduate programs where faculty have established expertise in transportation engineering, architecture, soil science, forestry, political science and psychology.

SELECTED ADVANCED UNDERGRADUATE COURSE

LAR 400 Intermediate Landscape Architecture Design (Series). *Preqs.: School of Design majors: DF 102; Horticultural Science-Landscape Technology option majors: DN 234. 6(0-9) F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

LAR 510 Participatory Communication Techniques for Designers. *Preq.: Grad. standing or CI; Coreq.: LAR 600. 3(1-2) F.* A techniques course in which students learn and apply the communication skills necessary in participatory design. An emphasis is placed on communication as a problem-solving process, on visual thinking and on graphic and small group techniques.

LAR 511 Community Design Policy. *Preq.: Grad. standing or CI. 3(3-0) S.* The course explores the theory and practices of the social policy impact on the designed environment and users of that environment. The public community development process is studied as it relates to the built environment.

LAR 512 Landscape Resource Management. *Preq.: DN 431 or CI. 3(1-4) S.* Laboratory techniques course in the methodology of analysis and management of natural resources as it relates to landscape architecture. Case study approach to managed resource systems using spatial mapping and analysis techniques.

LAR 521 Values, Theory and Methods of Landscape Architecture. *Preq.: Grad. standing. 3(3-0) F.* The profession of landscape architecture has undergone radical change in the past decade. Regional analysis, landscape assessment, land development, urban planning, recreation planning, etc., are new and emerging roles for the landscape architect. This course will develop the core values and theories from which each have emerged and survey the techniques and methods of their development.

LAR 531 Project Planning and Design. *Preq.: Grad. standing or CI; Coreq.: LAR 600. 3(3-0) F.* Issues in project planning, activity programming and site development are discussed in conjunction with assigned projects in the local area.

LAR 533 Plants and Design. *3(2-2) Every yr.* The course examines three landscape types: natural landscapes, landscapes altered by man and designed landscapes. Investigation of relevant plant materials and planting design processes is utilized to reveal natural principles as the basis for a design theory and methodology. Course assignments range from an analysis of actual plant materials and landscapes to the preparation of contract documents.

LAR 551 Ethics of Professional Practice in Landscape Architecture. *Preq.: Grad. standing or CI. 1(1-0) S.* An examination of the place of the professional in society, the contents of philosophies of various professional codes of ethics, the relationship of the practitioner with clients, peers and the public interest. It will include preparation of proposals, conduct as an expert witness, office organization and contracts.

LAR (RRA) 562 Computer Cartography. *3(3-0) S.* (See recreation resources administration.)

LAR 573 Historic Preservation. *Preqs.: Grad. standing and CI. 3(3-0) F.* Seminar covering the legal, administrative, fiscal and political aspects of preserving and conserving buildings, sites, districts, objects and landscapes of architectural, historical and design significance as related to community design and planning considerations. Subjects to be treated include federal, state and local statutes and ordinances; federal and state court decisions and administrative processes.

LAR 574 Landscape Design Controls. *Preqs.: Grad. standing and CI. 3(3-0) S.* Examination of local, state and federal law, affecting the visual quality of large-unit natural and built environments such as landscapes and townscapes, as expressed in local ordinances, state statutes, executive orders, administrative regulations and court decisions. Emphasis is placed on the legal, administrative, fiscal and governmental tools and processes for maintaining and enhancing visual environmental quality.

LAR 575 Development Planning. *Preq.: Grad. standing or CI. 3(3-0) F,S.* The seminar presents the concepts, processes and principles used in the design and development of communities. The discussions will focus on a general development process, the development team and the role of the designer in the context of the team. A wide range of project types will be discussed. The seminar presents the relationships of public regulatory policies and programs to the community design and development process.

LAR 591 Special Seminar. *Preq.: Grad. standing. 1-3 F,S.* Seminars on subjects of current interest in design which are presented by persons not part of the regular faculty.

LAR 592 Special Topics. *Preq.: Grad. standing. 2-3 F,S.* Topics of current interest to the programs in the School of Design offered by faculty in the School. Subjects offered under this number are normally used to test and develop new courses.

LAR 595 Independent Study. *Preq.: Grad. standing. Max. 6. F,S,Sum.* Special problems in various aspects of design developed under the direction of a faculty member on a tutorial basis.

FOR GRADUATES ONLY

LAR 600 Landscape Design Studio. *Preq.: Grad. standing. 6(0-12) F,S.* The application of information and skills developed in course work to environmental design problems. A process of site selection, activity programming, site planning, and program evaluation is followed which employs the creation of interactive communication systems between the designer, clients and users. Goals include the design of satisfying new landscapes as well as conservation and design strategies for existing culturally important landscapes and townscapes.

LAR 611 Advanced Community Design and Development Control. *Preq.: LAR 511. 3(1-3) S.* Advanced work in design and application of governmental planning and development control techniques to built environments, and impact of such controls on design solutions at varying scales. Emphasis is on design implications of complex control systems: development rights transfer, land use intensity rating systems, planned unit development regulations and other zoning and non-zoning site planning regulations.

LAR 612 Social Factors Analysis in Site Planning. *Preq.: LAR 511 or CI. 3(2-1) S.* The course explores social factors techniques and research applications to the design of the landscape. Interaction, neighborhood theory and user preference analysis techniques will be presented through discussion and development of research and case studies.

LAR 691 Degree Seminar. *Preqs.: 3 LAR 600 studios. 0.* Each student in his or her terminal semester not registered in any other courses and in conjunction with the terminal case study will prepare and submit to his or her committee a presentation on the relevance of one's minor to the design process with particular reference to the individual's case study.

LAR 698 Advanced Research Projects. *Preqs.: 2 LAR 600 studios or CI. 2-6 F,S.* Graduate students sufficiently prepared may undertake selected research investigations. A proposal for such investigations must be submitted prior to consent for enrollment.

Management

Professor D. M. Holthausen Jr., Coordinator

The Master of Science in management (MSM) is a unique multidepartmental degree combining the resources of the Departments of Economics and Business,

Civil Engineering, Industrial Engineering, Statistics and Textiles and the Computer Studies and Operations Research programs. The degree is distinguished from most MBA (Master of Business Administration) programs by its emphasis on quantitative analysis and applied economics. Applicants should have two semesters of calculus and one semester each of intermediate microeconomics and macroeconomics as prerequisites for the program.

The graduate program builds on a set of six undergraduate foundation courses that introduce the student to the principles of management decision making. Students whose undergraduate major has been either business or economics will likely have taken many or all of these courses. If the designated courses or their equivalents have not been included in the student's prior course work, their absence may be remedied by taking appropriate courses offered by the Department of Economics and Business.

Four core courses are required of every student. These are *Price Theory* (EB 501), *Income and Employment Theory* (EB 502), *Introduction to Operations Research* (OR 501) and *Introduction to Mathematical Statistics* (ST 421). In addition, one or two business economics electives are required along with four or five courses in a technical option. The technical option allows each student to specialize in a functional area offered by one of the seven departments granting the degree. The wide range of courses available permits each student in consultation with his Graduate Advisory Committee to tailor a technical option to suit his background and interests. Although a thesis is not required, a project paper is required in conjunction with the final 600-level course. Defense of the project analysis constitutes the basis for the final oral examination conducted by the student's Graduate Advisory Committee.

Selected courses are offered in the evening on a rotating basis for students who wish to pursue a course of part-time study. Approximately half of the students currently in the program have chosen this route. However, not all courses or technical options are available during the evening.

For additional information, contact Information Officer, Department of Economics and Business, P.O. Box 5368, North Carolina State University, Raleigh, N.C. 27650 [(919) 737-3273].

Marine, Earth and Atmospheric Sciences

GRADUATE FACULTY

Professor L. J. Langfelder, *Head*

Professors: S. P. S. Arya, G. Briggs, H. S. Brown, V. V. Cavaroc Jr., G. S. Janowitz—*Graduate Administrator*, L. J. Pietrafesa, W. J. Saucier, C. W. Welby; *Professors Emeriti:* C. J. Leith, J. M. Parker III; *Associate Professors:* J. M. Davis, R. V. Fodor, C. D. Harrington, D. Kamykowski, M. M. Kimberley, C. E. Knowles, A. J. Riordan, V. K. Saxena, S. SethuRaman, E. F. Stoddard, G. F. Watson, R. H. Weisberg, T. G. Wolcott, I. J. Won; *Adjunct Associate Professors:* W. D. Bach Jr., F. S. Binkowski, J. K. Ching, R. E. Eskridge, R. M. Flores; *Assistant Professors:* D. A. Barber, M. G. Bevis, T. B. Curtin, D. J. DeMaster, C. A. Nittrouer, W. J. Showers; *Visiting Assistant Professor:* V. R. Lamb

ASSOCIATE MEMBERS OF THE DEPARTMENT

Professors: M. Amein, B. J. Copeland, F. Y. Sorrell Jr., C. C. Tung; *Associate Professor:* J. M. Miller

The Department of Marine, Earth and Atmospheric Sciences offers graduate programs leading to the M.S. and Ph.D. degrees.

The Atmospheric Science areas of specialization include atmospheric dispersion, boundary layer flows and air quality; synoptic weather systems and weather forecasting; climatology and agricultural meteorology; and cloud and aerosol physics.

Areas of specialization in Earth Science include mineralogy, igneous and metamorphic petrology, sedimentology and sedimentary petrology, sedimentary geochemistry, economic geology, global and exploration geophysics, structural geology, hydrogeology and geomorphology. As geology and geophysics are considered distinct areas of study, students can major in one area and minor in the other.

In Marine Science, areas of specialization are biological, chemical, geological and physical oceanography, geophysical fluid dynamics and marine meteorology.

Admission with a specialization in Atmospheric Science requires a bachelor's degree in meteorology or other technical areas which include a background in chemistry, physics and mathematics. Candidates in Earth Science should hold a bachelor's degree in geology or a satisfactory equivalent, preferably with a strong background in physics, chemistry and mathematics. Graduate students in Marine Science are normally admitted after having received a baccalaureate degree in biology, chemistry, engineering, geology, mathematics, physics or meteorology.

In each discipline the master's program includes a minimum of 30 semester credit hours. Doctoral programs normally contain at least 50 semester credit hours beyond the B.S. degree, although course requirements are determined by the student's advisory committee. Graduate work includes major and minor fields and a research thesis. An M.S., non-thesis option is also available. Marine Science students are expected to be familiar with areas of marine studies other than their own and are required to complete two (three) courses from other Marine Science core areas in the M.S. (Ph.D.) program.

Sponsored research is being conducted in various areas of geology and geophysics, in air pollution and boundary layer meteorology, cloud and aerosol physics, and in Marine Science, in continental shelf, Gulf Stream and equatorial dynamics, geophysical fluid dynamics, sediment transport and water column biology. Graduate students are actively involved in the conduct of the research which often forms the basis of their theses. Research projects range from theoretical studies to international field experiments. Regional studies are being performed within the North Carolina Blue Ridge, Piedmont and Coastal Plain as well as in estuaries, on the continental shelf and slope and in equatorial regions.

Research facilities are available for analytical work in most areas of geology, geophysics and atmospheric sciences. Biological, chemical, geological and physical oceanography laboratories and shop facilities for electronic and mechanical equipment repair and fabrication are available for student use. Students also have on-

campus access to the TUCC IBM System 370/165 and Amdahl computers and to several smaller computing facilities operated by the department. Remote sensing capabilities are utilized in both research and classroom instruction. Collections of pertinent literature are available in the University library and elsewhere in the Research Triangle area. Consultation with scientists of the federal and state agencies in Raleigh as well as with the staffs of the neighboring universities is possible and encouraged.

The State of North Carolina operates three Marine Resources Centers on our coast where research space is available. Our students have also made use of facilities at Duke University's Marine Laboratory and the National Marine Fisheries Laboratory, both on Pivers Island, North Carolina. The department has a small boat and is a member of the Duke/UNC consortium that operates the new 131 ft. R/V Cape Hatteras.

Financial aid is available through both teaching assistantships (9 month) and research assistantships (9 or 12 month). Government agencies and industry occasionally provide part-time employment and small grants from the State are sometimes available to assist with thesis expenses.

Atmospheric Science

SELECTED ADVANCED UNDERGRADUATE COURSES

MEA 412 Atmospheric Physics. *Preqs.: MA 202, PY 208 or equiv. 3(3-0) S.*

MEA 421 Air Processes and Motions I. *Preqs.: MA 202, PY 208, MEA 311, 312, 313, 314. 4(3-2) F.*

MEA 422 Air Processes and Motions II. *Preq.: MEA 421. 4(3-2) S.*

MEA 443 Weather Analysis and Forecasting I. *Preq.: MEA 421. 3(1-6) F.*

MEA 444 Weather Forecasting Principles. *Preq.: MEA 443. 3(2-3) F.*

MEA 455 Micrometeorology. *Preq.: MEA 422 or MAE 402. 3(3-0) F.*

MEA 493 Special Topics in Meteorology. *Preq.: Consent of department. 1-3 F,S,Sum.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

MEA 512 Satellite Meteorology. *Preq.: MA 202; Coreq.: MEA 443. 3(3-0) Alt. S.* Basic background in satellite orbits, coordinate systems and image navigation; description of sensors and techniques for quantitative measurement of atmospheric variables. Applications of satellite data in analysis of weather systems; evolution of convective systems, tropical disturbances and mid-latitude cyclones as revealed by visible and infrared imagery; current research in satellite applications. (Offered S 1985 and alt. years.)
 Riordan

MEA 521 The Upper Atmosphere. *Preq.: MEA 311 or CI. 3(3-0) S,Sum.* Meteorological conditions in the upper atmosphere from the stratosphere to the ionosphere. Compositions, mean distributions and variability, circulation and transport properties in the region. Physical theories.
 Graduate Staff

MEA 524 Dynamic Meteorology. *Preq.: MEA 422 or equivalent. 3(3-0) F.* A brief review of the classical and physical hydrodynamics; scale analysis of dynamic equations; atmospheric instabilities; dynamics of tropical convections; perturbation theory and approximations for atmospheric wave motions. Barber

MEA 525 Numerical Weather Prediction. *Preqs.: MEA 524, CSC (MA) 427 or equivalent and some FORTRAN programming experience. 3(3-0) Alt. F,S.* Physical and mathematical basis of numerical weather prediction with computer experiments to demonstrate principles and techniques. Topics include derivation of sets of prediction equations consistent with scale analysis and dynamical constraints; atmospheric waves and filtered equations; numerical methods and computational instabilities; filtered and primitive equation models; NWS operational models. Watson

MEA 526 Air-Sea Interaction. *Preq.: MEA 422 or MEA 560 or CI. 3(3-0) Alt. S.* Review of basic equations and concepts of turbulent transfer in geophysical flows, air-sea interaction processes and their importance to man's activities, theory and observation of wind-generated ocean surface waves, turbulent transfers in the planetary boundary layer of the marine atmosphere, oceanic mixed layer, development of thermocline and inversion. SethuRaman

MEA 527 Planetary Boundary Layer. *Preq.: MEA 455 or MEA 526 or CI. 3(3-0) Alt. F,S.* Review of the basic equations and concepts of planetary boundary layers. Study of the closure problem and semi-empirical theories of turbulence, buoyancy effects on mean flow and turbulence, instrumentation and observational platforms for PBL experiments, observed characteristics of atmospheric boundary layers, numerical and physical modeling of PBL and its parameterization in large-scale atmospheric circulation models. Arya

MEA 555 Meteorology of the Biosphere. *Preqs.: PY 205 or 211; CH 103 or 107; MA 102 or 112. 3(3-0) F.* A course designed for graduate students in the life sciences, presenting the physical principles governing the states and processes of the atmosphere in contact with earth's surface of land, water and life. Exchanges of heat, mass and momentum are analyzed for various conditions of the atmosphere and surface and as a function of season, time and geographic location. Davis

MEA 556 Air Pollution Meteorology. *Preqs.: MA 201 or 212, PY 208 or 212, CH 103 or 105 or 107 or equivalent. 3(3-0) F.* Wind structure in the atmospheric surface layer and planetary boundary layer; temperature structure and stability; mixed layer and inversions; turbulence intensity and scale; meteorological factors affecting the dispersion of pollutants; diffusion theories and models; diffusion and transport experiments; plume rise, fumigation and trapping; removal processes; effects of buildings and hills; effects of local winds. Arya

MEA 557 Advanced Cloud and Precipitation Physics. *Preq.: MEA 421 or MEA 412. 3(3-0) Alt. F.* An analysis of the microstructure of warm and cold clouds and precipitation, cloud microphysics-dynamics interactions, formation of cloud droplets, growth of cloud droplets by condensation, initiation of rain in nonfreezing clouds, formation and growth of ice crystals, precipitation theories, planned and inadvertent weather modification and the problem of acid rain. Saxena

MEA 558 Atmospheric Aerosols. *Preqs.: CH 103 or 107 and PY 205 or 211; Coreq.: MEA 412. 3(3-0) Alt. S.* An understanding of aerosols as primary air pollutants, indoor versus outdoor pollution, transformation processes, prediction of atmospheric concentrations, scavenging of aerosols, transport of air pollutants on a regional scale, discussion of national experiments to characterize and study the impact of urban-industrial pollution, tropospheric aerosol and weather, stratospheric aerosol, effect of aerosols on atmospheric warming and cooling and air-quality models. Saxena

MEA 593 Special Topics. *Preq.: CI. 1-6 F,S,Sum.* Special topics in meteorology, provided to groups or to individuals. Graduate Staff

FOR GRADUATES ONLY

MEA 614 Atmospheric Radiative Transfer. *Preq.: MEA 412. 3(3-0) S.* The study of solar and terrestrial radiation. Methods of actinometric measurements, radiation absorption in the atmosphere, scattering of radiation, the solar spectrum, infrared radiative transfer and methods of determining net radiation. Satellite measurement of radiation and determination of atmospheric properties from satellite measurements. Saxena

MEA 627 Atmospheric Turbulence and Diffusion. *Preq.: MEA 422. 3(3-0) F.* Mechanics of turbulence in the atmosphere, spectra and scales of atmospheric turbulence and magnitudes of turbulent fluctuations. Theories of diffusion in the atmosphere. Diffusion and transport experiments. Processes other than natural turbulence affecting concentration of effluents. Arya

MEA 635 Dynamical Analysis of the Atmosphere. *Preqs.: MEA 441, 443. 3(2-3) F.* Theory and analysis of circulation and weather systems based on dynamical concepts; structure, movement and development of systems; evaluation of theoretical concepts in prognosis and forecasting. Saucier

MEA 695 Seminar. *Preq.: Grad. standing. 1(1-0) F,S.* Presentation of scientific articles and special lectures. Each student is required to present or critically review one or more papers. Graduate Staff

MEA 699 Research. *Preqs.: Grad. standing and consent of advisory committee. Credits Arranged. F,S.* Graduate research in fulfillment of requirements for a graduate degree. Graduate Staff

Earth Science

SELECTED ADVANCED UNDERGRADUATE COURSES

MEA 415 Geology of Metalliferous Deposits. *Preqs.: MEA 440, MEA 452. 3(2-3) S.*

MEA 423 Invertebrate Paleontology and Biostratigraphy. *Preqs.: MEA 201/210 or ZO 202. 4(3-3) F.*

MEA 440 Igneous and Metamorphic Petrology. *Preq.: MEA 331. 4(3-3) F.*

MEA 452 Sedimentary Petrology and Stratigraphy. *Coreq.: MEA 331. 4(3-3) S.*

MEA 461 Engineering Geology. *Preq.: MEA 101 or 120. 3(3-0) F.*

MEA 465 Geologic Field Camp I. *Preqs.: MEA 351, 440, 452. First part of 6 weeks out-of-state summer field camp. Both MEA 465 and 466 must be taken in the same summer. 3 Sum.*

MEA 466 Geologic Field Camp II. *Preq.: MEA 465. Second part of 6 weeks out-of-state summer field camp. Both MEA 465 and 466 must be taken in the same summer. 3 Sum.*

MEA 470 Principles of Geophysics. *Preqs.: PY 208 or 212; MEA 120 or equivalent recommended. 3(3-0) F.*

MEA 481 Principles of Geomorphology. *Preq.: MEA 201 or equivalent. 3(2-2) F.*

MEA 491 Seminar on Selected Geologic Topics. 1-3 F.**FOR GRADUATES AND ADVANCED UNDERGRADUATES**

MEA 500 Regional Geology of North America. *Preqs.: MEA 101 or 120, sr. standing. 1-6 F,S.* Field study of classic geologic localities and geomorphic processes not indigenous to North Carolina. Typical areas are New England and adjacent Canada, northern Mexico and southwestern United States and the Pacific Northwest. Representative subjects include the Canadian Shield, Precambrian mineral deposits, the San Andreas fault, desert geomorphology, Grand Canyon stratigraphy, modern and ancient reefs and glaciated volcanoes. Mineral, rock and fossil collecting. Student reports required. Graduate Staff

MEA 510 Geological Oceanography. *Preq.: MEA 452 or equivalent. 3(3-0) F.* A comprehensive overview of the geological aspects of oceanography. Topics include: a) marine geophysics and the evolution of ocean basins, b) sedimentological processes and the formation of marine deposits, c) marine geochemistry and authigenic sedimentation, d) paleoceanography and the interpretation of marine stratigraphy. Nittrouer

MEA 515 Topics in Southern Appalachian Geology. *Preqs.: MEA 351 and MEA 440 or equivalent. 3(3-0) Alt. F.* Examination of the geology of North Carolina and surrounding areas. Lectures, discussions, reading of and review of current literature and consideration of ideas concerning the geological evolution of the area. A term project on a selected topic is required. Required field trips. (Offered F 1985 and alt. years.) Stoddard

MEA 522 Petroleum Geology. *Preq.: MEA 452. 3(3-0) Alt. S.* Properties, origin and modes of occurrence of petroleum and natural gas. Geologic and economic features of the principal oil and gas fields, mainly in the United States. (Offered S 1984 and alt. years.) Graduate Staff

MEA 523 Introduction to Subsurface Well Evaluation. *Preqs.: CH 103, PY 212, MEA 120. 3(2-3) Alt. F.* Principles, uses and interpretation of commonly used wireline technique for structural, lithologic and fluid evaluation of wells. Oriented towards petroleum reserve/evaluations. (Offered F 1985 and alt. years.) Cavaroc

MEA 532 Ore Microscopy. *Preq.: MEA 331. 3(0-6) Alt. F.* The theory and technique of microscopic investigation of opaque ore minerals, ores and mill products produced by beneficiation of ores. Studies of compositions and textures of materials in polished surfaces are based on observations of optical and physical properties, etch reactions and microchemical tests. (Offered F 1985 and alt. years.) Brown

MEA 542 Intermediate Petrographic Analysis. *Preq.: MEA 440 or equivalent. 2(0-5) F.* Systematic study of rocks in thin section by means of the petrographic microscope. Mineralogy, mineral and rock compositions and rock textures applied to an interpretation of the origin and crystallization or depositional history of specimens studied. Suites representative of each of the three major rock groups will be studied during the first half of the semester; during the remainder of the semester, the student will concentrate on suites representative of his/her area of specialization. Cavaroc, Stoddard

MEA 545 Advanced Igneous Petrology. *Preq.: MEA 440. 3(2-2) Alt. S.* Physicochemical principles related to igneous petrogenesis. General principles and specific problems including the origin, differentiation and emplacement of magmas and the possible relationships of igneous processes to global tectonics. (Offered S 1984 and alt. years.) Fodor

MEA 546 Advanced Metamorphic Petrology. *Preq.: MEA 440. 3(2-2) Alt. S.* The petrogenesis of metamorphic rocks including conditions of metamorphism, metamorphic facies and facies series, the petrogenetic grid, contact and regional metamorphism,

metamorphism and plate tectonics. Heterogeneous chemical equilibrium and application of Gibbs Phase Rule to metamorphic rocks. Thermodynamically valid algebraic and graphical analysis of equilibrium mineral assemblages. Chemical zoning. Petrographic studies of selected metamorphic suites. (Offered S 1985 and alt. years.) Stoddard

MEA 551 Advanced Structural Geology. *Preq.: MEA 351. 3(2-3) Alt. F.* Principles of rock mechanics and their application in solving geologic problems; finite strain analysis of deformed rocks; advanced techniques of structural analysis; petrofabrics; development of various geologic structures. Course is designed to emphasize the application of principles and techniques in the field. (Offered F 1984 and alt. years.) Karlstrom

MEA 562 Applied Sedimentary Analysis. *Preqs.: MEA 452, ST 361. 3(2-2) Alt. F.* Extension of MEA 452, with emphasis on coarser grained clastic sedimentary rocks. Sampling of sedimentary population, critical study of assumptions underlying standard measurement techniques; treatment, testing and evaluation of sedimentary data; application to problems in sedimentology. (Offered F 1984 and alt. years.) Cavaroc

MEA 564 Depositional Environments and Lithostratigraphy. *Preq.: MEA 452 or grad. standing. 3(2-3) S.* Fabric of large sedimentary basins in terms of the spatial distribution of component major rock facies; current litho-genetic models based upon comparison with recent equivalents; field trips. Cavaroc

MEA 565 Hydrogeology. *Preq.: MEA 452. 3(3-0) Alt. S.* Occurrence and sources of surface and subsurface water. Relationships of surface water to subsurface water. Rock properties affecting infiltration, movement, lateral and vertical distribution and quality of ground water. Determination of permeability, capacity, specific yield and other hydraulic characteristics of aquifers. Principles of well design, legal aspects of water supplies. (Offered S 1985 and alt. years.) Welby

MEA 566 Hydrogeology of Groundwater Pollution and Protection. *Preq.: MEA 565 or CE 543 or equivalent. 3(3-0) Alt. S.* Hydrogeologic factors associated with protection of groundwater; use of geologic principles and materials to protect groundwater quality; geologic evaluation and monitoring of waste disposal sites, including appropriate models. (Offered S 1984 and alt. years.) Welby

MEA 567 Geochemistry. *Preq.: CH 331 or 433. 3(3-0) Alt. F.* The quantitative distribution of elements in the earth's crust, the hydrosphere and the atmosphere. Application of the laws of chemical equilibrium and resultant chemical reactions to natural earth systems. Geochemical application of Eh-pH diagrams. Geochemical cycles. Isotope geochemistry. (Offered F 1984 and alt. years.) Kimberley

MEA 570 Exploration and Engineering Geophysics. *Preq.: MEA 470 or PY 207 or PY 208 or equivalent. 3(3-0) S.* Geophysical methods as applied to exploring the earth's mineral and energy resources and investigating subsurface geological structure and its physical properties. Principles, measurements, analyses, and interpretations of gravity, magnetic, electric, electromagnetic, seismic methods. Won

MEA 572 Laboratory and Field Methods for Investigation of the Seabed. *Preqs.: MEA 510 or CH 107 or MEA 571. 3(2-3) Alt. S.* An initial lecture and laboratory phase acquaints the student with the use of advanced techniques and instrumentation for chemical and geological oceanographic investigations. A field project in the coastal waters of North Carolina and then allows application of these tools to a specific marine problem. (Offered S 1985 and alt. years.) DeMaster, Nittrouer

MEA 575 Geophysical Field Methods. *Preq.: MEA 570. 2(2-week summer camp) Alt. Sum.* Two-week summer field course. Practical geophysical field measurements using instruments for gravity, magnetic, electric, electromagnetic and radioactivity methods. Data interpretation in terms of subsurface geological structures and their physical properties, locations, sizes and shapes. Students are required to register for the course in the second summer session. Location: within the state of North Carolina. (Offered Sum. 1985 and alt. years.) Won

MEA 577 Sedimentary Geochemistry. *Preq.: CH 331 or CH 431 or MEA 567 or equivalent background. 3(3-0) Alt. S.* This course applies thermodynamic data to the calculation of reactions in natural waters at or near the earth's surface. Topics include weathering to form clay minerals, precipitation of economic minerals and carbonate sedimentology. (Offered S 1984 and alt. years.) Kimberley

MEA 580 Remote Sensing. *Preq.: FOR 353 or CE 507 or MEA 481 or equivalent background. 3(2-1) F.* The course introduces the student to the principles and use of various remote sensing techniques such as satellite imaging, thermal scanning, side-looking airborne radar (SLAR) and multispectral aerial photography. Each student concentrates his attention in the problem sessions upon utilization of the various sensors in his own discipline. Welby

MEA 581 Advanced Geomorphology. *Preq.: MEA 481 or other equivalent background. 3(2-3) Alt. S.* The application of quantitative techniques to the study of the geologic processes responsible for the formation and modification of land forms. Analysis of processes and landforms related to drainage basins, and regions of karst, glacial and coastal geomorphology. Emphasis on geomorphic areas in North Carolina. Field trips. (Offered S 1985 and alt. years.) Harrington

MEA 582 Quaternary Geology. *Preqs.: MEA 101 or 120, sr. standing. 3(3-0) Alt. S.* Glaciology, glacial geology, Pleistocene stratigraphy, periglacial geomorphology; Quaternary volcanism, tectonism and sea-level fluctuations; late Cenozoic climate changes; field trips. (Offered S 1984 and alt. years.) Harrington

MEA 583 Photogeology. *Preq.: MEA 101 or 120. 3(2-2) S.* The stereoscopic study of aerial photographs to obtain geologic information. The construction of bedrock and surficial geologic maps from aerial photographs. Aspects of remote sensing useful in geological interpretation. Harrington

MEA 588 Regional Tectonics. *Preqs.: MEA 351, 440, 452. 3(3-0) Alt. S.* Methods of study of the tectonic history of major geologic regions in North America and other areas of the world through the application of stratigraphy, petrology and structural geology. Synthesizing regional tectonic patterns and events. (Offered S 1984 and alt. years.) Graduate Staff

MEA 593 Special Topics. *Preq.: CI. 1-6 F,S.* Special study of some advanced phases of geology. Graduate Staff

MEA 598 Advanced Topics in Geophysics. *Preq.: CI. 1-6 F,S,Sum.* Special study of some advanced phases Graduate Staff

FOR GRADUATES ONLY

MEA 610 Marine Sedimentology. *Preq.: MEA 510. 3(3-0) Alt. S.* A quantitative examination of sedimentology with specific reference to the marine environment including an introduction to fluid mechanics, sediment transport theory, quantitative models of sedimentation and dynamic stratigraphy. (Offered S 1985 and alt. years.) Nittrouer

MEA 611, 612 Advanced Economic Geology. *Preqs.: MEA 440, 452. 3(3-0) F,S.* Detailed study of the origin and economic occurrence of specific mineral deposits. Brown

MEA 630 Geotectonics. *Preqs.: MEA 351, 440, 452. 3(3-0) Alt. F.* In-depth examination of current ideas in plate tectonic theory. Plate tectonic controls on orogeny, orogenic belts, magmatism and metallogeny. (Offered F 1985 and alt. years.) Bevis, Karlstrom

MEA 670 Applied Geophysics I. *Preqs.: MEA 570 and MA 401. 3(3-0) Alt. F.* Mathematical treatment of geophysical principles and their application to oil and mineral resources exploration and geotechnical engineering problems using the gravity, magnetic and electrical methods. Development of exploration techniques and data interpretation methods with case histories. (Offered F 1984 and alt. years.) Bevis, Won

MEA 671 Applied Geophysics II. *Preqs.: MEA 570 and MA 401. 3(3-0) Alt. F.* Mathematical treatment of geophysical principles and their application to oil and mineral resources exploration and geotechnical engineering problems using the seismic and electromagnetic methods. Developments of exploration techniques and data interpretation methods with case histories. (Offered F 1983 and alt. years.) Bevis, Won

MEA 695 Seminar. *Preq.: Grad. standing. 1(1-0) F,S.* Scientific articles, progress reports and special problems of interest to geologists and geological and mining engineers discussed. Graduate Staff

MEA 698 Geophysical Research. *Preq.: CI. Credits arranged. F,S,Sum.* Thesis research in geophysics. Graduate Staff

MEA 699 Research. *Preq.: CI. Credits Arranged. F,S,Sum.* Lectures reading assignments and reports; special work in geology to meet the needs and interests of the students. Thesis problem. Graduate Staff

Marine Science

FOR GRADUATES AND ADVANCED UNDERGRADUATES

MEA 510 Geological Oceanography. *Preq.: MEA 452 or equivalent. 3(3-0) F.* A comprehensive overview of the geological aspects of oceanography. Topics include: a) marine geophysics and the evolution of ocean basins, b) sedimentological processes and the formation of marine deposits, c) marine geochemistry and authigenic sedimentation, d) paleoceanography and the interpretation of marine stratigraphy. Nittrouer

MEA (ZO) 520 Principles of Biological Oceanography. *Preqs.: BS 100 and either BO (ZO) 360 or grad standing. 3(3-0) S.* Biological productivity and trophic relationships in Plankton, Nekton and Benthos; community ecology of selected habitats (estuaries, intertidal zones, coral reefs, deep sea) and adaptation of organisms to the marine environment. Wolcott

MEA 526 Air-Sea Interaction. *Preq.: MEA 422 or MEA 560 or CI. 3(3-0) Alt. S.* Review of basic equations and concepts of turbulent transfer in geophysical flows, air-sea interaction processes and their importance to man's activities, theory and observation of wind-generated ocean surface waves, turbulent transfers in the planetary boundary layer of the marine atmosphere, oceanic mixed layer, development of thermocline and inversion. (Offered S 1984 and alt. years.) SethuRaman

MEA (CE) 541 Gravity Wave Theory I. *Preq.: MAE 308 or PY 411. 3(3-0) S.* Classical gravity wave theory with emphasis on the basic mechanics of wave motions, mass transport induced by waves and various conservation laws with their applications in wave study. Weisberg

MEA 560 Principles of Physical Oceanography. *Preqs.: MA 212 and PY 212 or equivalent. 3(3-0) S.* An introduction to the principles and practice of physical oceanography. Subjects to be covered include: the equation of state of seawater; energy transfer to the ocean by thermal, radiative and mechanical processes; the heat budget; oceanic boundary conditions; the geographical distribution of oceanic properties; observational methods; conservation equations; simple waves and tides; physical oceanography of the North Carolina coastal zone. Knowles

MEA 561 Introduction to Physical Oceanography. *Preqs.: MA 301, PY 208 or CI 3(3-0) F.* An introduction to the descriptive and dynamical features of ocean circulation. Topics to be covered include the physical properties of seawater, oceanic heat budget, fluid mechanics, dynamics of ocean currents, descriptive oceanography, tides and other waves. Curtin

MEA (MAE) 563 Geophysical Fluid Mechanics. *Preq.: MAE 550 or equivalent. 3(3-0) Alt. F.* The principles of fluid mechanics are applied to geophysical systems. Special emphasis is placed on those features of these systems, such as almost rigid rotation and stable stratification, which produce unique and important effects. The effects of almost rigid rotations on homogeneous and stratified flows are examined in detail. (Offered F 1985 and alt. years.) Janowitz

MEA 568 Ocean Circulation. *Preq.: MAE 308 or PY 411. 3(3-0) F.* Basic study of the mechanics of ocean circulation with emphasis on various simple models of circulation systems. Pietrafesa

MEA 569 The Physical Dynamics of Estuaries. *Preqs.: MA 202 or 212; PY 208 or 212 or CI 3(3-0) Alt. S.* A physical/dynamical description of estuaries and estuarine processes which occur as a function of tides, atmospheric forcing, river runoff and topography. Includes classification schemes; the development of salt, heat energy and momentum balances; a discussion of biological modeling and sediment transport processes as a function of the physical dynamics; conservative and non-conservative pollution dispersion prediction; and the theoretical, mathematical modeling of estuaries, including those in North Carolina. (Offered S 1985 and alt. years.) Pietrafesa

MEA 571 Principles of Chemical Oceanography. *Preq.: CH 107 or equivalent. 3(3-0) F.* Chemical processes which control the composition of the oceans, including discussions of chemical equilibria, biological cycling of nutrients and the use of chemical tracers in the marine environment; the origin and chemical history of the oceans are also considered. DeMaster

MEA 572 Laboratory and Field Methods for Investigation of the Seabed. *Preqs.: MEA 510 and CH 107 or MEA 571. 3(2-3) Alt. S.* An initial lecture and laboratory phase acquaints students with the use of advanced techniques and instrumentation for chemical and geological oceanographic investigations. A field project in the coastal waters of North Carolina then allows application of these tools to a specific marine problem. (Offered S 1985 and alt. years.) DeMaster, Nittrouer

MEA 591, 592 Seminar. *1(1-0) S.* A seminar designed to give perspective in the field of marine science. Topics vary from semester to semester. In order to obtain credit a student must deliver a seminar. Graduate Staff

MEA 593 Special Topics. *Preq.: CI 1-3 F,S.* This course provides the opportunity for advanced undergraduate and graduate students to study timely special problem areas in marine science and engineering. Graduate Staff

FOR GRADUATES ONLY

MEA 610 Marine Sedimentology. *Preq.: MEA 510. 3(3-0) Alt. S.* A quantitative examination of sedimentology with specific reference to the marine environment including an introduction to fluid mechanics, sediment transport theory, quantitative models of sedimentation and dynamic stratigraphy. (Offered S 1985 and alt. years.) Nittrouer

MEA 613 Continental Margin Sedimentation. *Preq.: MEA 510. 3(3-0) Alt. S.* A detailed examination of the processes and sedimentation active along continental margins. The specific environments explored are the continental shelf, slope and rise. (Offered S 1985 and alt. years.) Nittrouer

MEA 622 Marine Plankton Ecology. *Preqs.: BCH 451 and MA 212 and ZO 419 or equivalents. 3(3-0) Alt. F.* This course will examine the worldwide relationships between the physical-chemical environment and planktonic organisms. Topics include organism descriptions; the effects of light, temperature, salinity, density, water motion and chemical constituents on organisms; interactions among different organisms emphasizing competition and predation; community structure, distribution and succession; and mathematics models of distribution, production and interaction. Kamykowski

MEA (ZO) 623 Benthic Ecology. *Preq.: Basic course in aquatic biology. 3(3-0) Alt. S.* Marine benthic systems in the deep sea and in shallow waters, focusing upon the abiotic and biotic processes which regulate density, diversity and taxonomic and functional composition. Included are discussions of benthic-pelagic coupling, predation, interspecific competition, biogeography, sampling problems, evolutionary trends, trophic structure and community organization. (Offered S 1984 and alt. years.) Levin

MEA (ZO) 624 Ecology of Fishes. *Preq.: BO (ZO) 360 or 560 or equivalent. 3(3-0) F.* Physiological ecology of fishes emphasizing energetics, production and adaptations to aquatic mediums. Ecological classification of fishes and theory of resource partitioning in freshwater, estuarine and marine realms. Miller

MEA (MAE) 663 Advanced Geophysical Fluid Mechanics. *Preq.: MAE 550 or equivalent. 3(3-0) Alt. S.* The principles of fluid mechanics are applied to geophysical systems. Special emphasis is placed on the role of stable stratification on the flows in these systems. The generation, interaction, propagation and dissipation of internal gravity waves are studied in detail. Other geophysically important flows are also studied. (Offered S 1984 and alt. years.) Janowitz

MEA (MAE) 664, 665 Perturbation Method in Fluid Mechanics I, II. *Preqs.: MA 401, MAE 308. 3(3-0) F,S.* Basic theory and application of perturbation methods in fluid mechanics including: regular and singular perturbations, matching principles, method of strained coordinate, two variable expansion and applications to partial differential equations. (Offered 1984-85 and alt. years.) Janowitz

MEA 674 Marine Geochemistry. *Preqs.: CH 331, MEA 571 or equivalent. 3(3-0) Alt. S.* A detailed examination of the chemical processes occurring in the marine environment. Topics discussed include: chemical evolution of the oceans, continental and submarine weathering, particle scavenging of reactive elements from the water, column, formation of biogenic and metalliferous deposits, sediment diagenesis and marine geochronology. (Offered S 1985 and alt. years.) DeMaster

MEA 693 Advanced Special Topics. *Preqs.: Grad. standing and CI. 1-3.* This course will provide the opportunity for advanced graduate students to study in special problem areas in marine sciences. Various areas in the program may use this course concurrently in their areas. Graduate Staff

MEA 699 Research. *Preqs.: Grad. standing and consent of advisory committee. Credits Arranged. F,S.* Graduate Staff

Materials Engineering

GRADUATE FACULTY

Professor H. Conrad, Head

Professors: J. R. Beller Jr., R. E. Benson Jr., R. F. Davis, A. A. Fahmy, K. L. Moazed, H. Palmour III, G. A. Rozgonyi, R. O. Scattergood—*Graduate Administrator*, H. H. Stadelmaier, R. F. Stoops—*Associate Head of the Department; Adjunct Professors:* C. R. Manning Jr., G. Mayer; *Professors Emeriti:* W. W. Austin, J. K. Magor; *Adjunct Associate Professor:* J. C. Hurt; *Associate Professors Emeriti:* J. V. Hamme, G. O. Harrell; *Assistant Professors:* C. M. Balik, R. L. Porter; *Adjunct Assistant Professor:* P. A. Parrish; *Lecturer:* D. D. Macaras

The Department of Materials Engineering offers graduate programs leading to the degrees of Master of Science, Master of Materials Engineering and Doctor of Philosophy. Students with appropriate backgrounds in engineering, chemistry or physics can be accommodated, although most students enter the program with degrees in a materials-related discipline. Financial aid is available on a competitive basis to qualified students.

Graduate students in materials engineering are involved with academic studies and research programs that focus on understanding the structure, structure modification and properties of materials. Included is the development of new or improved materials and advanced processing methods, which are critical links between the design and the realization of new systems. Materials and materials limitations pervade all of the engineering and high technology fields that are an integral part of our society. The challenges and opportunities for graduates in materials engineering are exceptional.

Research in the department comprises a wide range of programs that deal with physical, chemical and mechanical behavior involving both bulk and surface phenomena in metals, ceramics and polymers. There are rapidly growing activities in the areas of microelectronic materials, advanced processing methods for metals and ceramics, non-equilibrium structures and surface modification processes. The research programs are supported by state-of-the-art facilities for preparation, processing and characterization of materials. An ion-beam microprobe, analytical scanning-transmission microscopy and VAX-based computer facility are among the recent acquisitions that support departmental research programs.

The faculty in materials engineering offers experience in all of the basic materials-related disciplines. Each student's program is designed to provide the appropriate balance of academic and research work consistent with that student's background and career objectives.

A brochure describing the department's graduate programs, research interests and faculty members is available upon request.

SELECTED ADVANCED UNDERGRADUATE COURSES

MAT 400 **Metallic Materials in Engineering Design.** *Preq.: MAT 200 or 201. 3(3-0) F,S.*

MAT 410 **Computer Applications for Metallurgical Engineering.** *Preqs.: CSC 111 and MAT 320. 3(3-0) S.*

MAT 411 **Physical Principles in Materials Science I.** *Preq.: MAT 321. 3(3-0) F.*

MAT 423 **Materials Factors in Design I.** *Preq.: MAT 450. 3(1-6) S.*

MAT 431 **Physical Metallurgy I.** *Preq.: MAT 321. 3(2-3) F.*

MAT 432 **Physical Metallurgy II.** *Preq.: MAT 431. 3(3-0) S.*

MAT 435 **Physical Ceramics I.** *Preq.: MAT 321. 3(2-3) F.*

MAT 436 **Physical Ceramics II.** *Preq.: MAT 435. 3(2-3) S.*

MAT 450 **Mechanical Properties of Materials.** *Preq.: MAT 200 or MAT 201 or MAT 310. 3(2-3) F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

MAT 500 **Modern Concepts in Materials Science.** *Preq.: MAT 321. 3(3-0) F.* Fundamentals of structure, structure modification and properties of materials with emphasis on structure-property relationships and the modern theory of solids.

MAT 503 **Ceramic Microscopy.** *Preq.: MEA 331. 3(2-3) F.* Transmitted and reflected light techniques for the systematic study of ceramic materials and products.

MAT 509 **High Vacuum Technology.** *Preq.: CH 433 or MAE 301. 3(2-3) F,S.* Properties of low-pressure gases and vapors. Production, maintenance and measurement of high vacuum; design, construction and operation of high vacuum-high temperature facilities. Properties and reactions of materials which are processed, tested and/or utilized in high vacuum environments.

MAT 510 **Structure of Crystalline Materials.** *Preq.: MAT 411; Coreq.: MAT 500. 3(3-0) F.* The lattice structure of crystals, including group theory applications, reciprocal lattice concept and the study of crystal structure as related to bonding.

MAT 520 **Theory and Structure of Materials.** *Preq.: MAT 510. 3(3-0) S.* Structure of liquids and crystalline and amorphous solids used in engineering systems. Crystallinity and thermal properties. Ionic crystals in ceramic systems. The metallic state and alloy behavior. Emphasis on the relation between fundamental materials parameters and engineering properties.

MAT 527 **Refractories in Service.** *Preq.: MAT 411. 3(3-0) S.* A study of the physical and chemical properties of the more important refractories in respect to their environment in industrial and laboratory furnaces.

MAT 529 **Properties of High Temperature Materials.** *Preqs.: MAT 201 and MAE 301. 3(3-0) S.* Effects of temperature on the physical, mechanical and chemical properties of inorganic materials; relationships between microstructure and high temperature properties; applications of ceramics, metals and composites at elevated temperatures.

MAT 530 Phase Transformations in Materials I. *Coreq.: MAT 500. 3(3-0) F,S.* Kinetic theory of transformations, nucleation theory, homogeneous and heterogeneous nucleation, growth of crystals, epitaxial thin films.

MAT (MAE) 531 Materials Processing by Deformation. *3(3-0) F.* (See mechanical and aerospace engineering.)

MAT (MAE) 532 Fundamentals of Metal Machining Theory. *3(3-0) S.* (See mechanical and aerospace engineering.)

MAT 533, 534 Advanced Ceramic Engineering Design I, II. *Preq.: MAT 417. 3(2-3) F,S.* Advanced studies in analysis and design of ceramic products, processes and systems leading to original solutions of current industrial problems and the development of new concepts of manufacturing.

MAT 540 Glass Technology. *Preq.: MAT 435. 3(3-0) F.* Fundamentals of glass manufacture including compositions, properties and application of the principal types of commercial glasses.

MAT 541, 542 Principles of Corrosion I, II. *Preqs.: MAT 201 and CH 431 or MAE 301. 3(2-3) F,S.* The fundamentals of metallic corrosion and passivity. The electro-chemical nature of corrosive attack, basic forms of corrosion, corrosion rate factors, methods of corrosion protection. Laboratory work included.

MAT 550 Dislocation Theory. *Preq.: MAT 450. 3(3-0) F.* Structure, energetics, stress and strain fields, interactions and motion of dislocations in solids.

MAT 556 Composite Materials. *Preq.: MAT 450. 3(3-0) F.* Basic principles underlying the properties of composite materials as related to properties of the individual constituents and their interactions. Emphasis on the design of composite systems to yield desired combinations of properties.

MAT (NE) 562 Materials Problems in Nuclear Engineering. *Preq.: Advanced undergrad. standing. 3(3-0) F.* Reactor design and operating considerations determined by materials properties. Emphasis on the interrelations among materials, compatibility effects, corrosion effects and radiation effects in fission and fusion reactors.

MAT (NE) 573 Computer Experiments in Materials and Nuclear Engineering. *Preq.: Advanced undergrad. standing. 3(3-0) S.* Monte Carlo and dynamical computer experiments are covered from the standpoint of how to design and use them in materials and nuclear engineering work.

MAT 595 Advanced Materials Experiments. *Preq.: Sr. or grad. standing. 1-3.* Advanced engineering principles applied to a specific experimental project dealing with materials. A seminar period is provided and a written report is required.

FOR GRADUATES ONLY

MAT 601 Ceramic Phase Relationships. *Preq.: CI. 3(3-0) S.* Heterogeneous equilibrium phase transformations, dissociation, fusion, lattice energy, defect structure, thermodynamic properties of ionic phases and silicate melts.

MAT 603 Advanced Ceramic Reaction Kinetics. *Preq.: MAT 510. 3(3-0) S.* Fundamental study of the kinetics of high temperature ceramic reactions such as diffusion, nucleation, grain growth, recrystallization, phase transformation, vitrification and sintering.

MAT 610 X-ray Diffraction. *Preq.: MAT 510. 3(3-0) F.* The properties and scattering behavior of x-rays by electrons, ions and atoms. Theory and applications of x-ray diffraction techniques such as Laue back reflection, the rotating crystal and powder methods, texture studies, residual stress analysis, radial distribution in amorphous materials and small angle scattering.

MAT 615 Electron Microscopy. *Preqs.: MAT 550, 610. 3(3-0) F.* Theory of imaging and diffraction of electrons. Analysis of structures using electron microscopy.

MAT 621 Theory and Structure of Amorphous Materials. *Preq.: MAT 520. 3(3-0) S.* Bond types and structure of amorphous solids, relations of bond types and structure to flow mechanisms, electrical, optical and thermal properties.

MAT 622 Theory and Structure of Ceramic Materials. *Preq.: MAT 520. 3(3-0) F.* Electrical and optical properties of non-conducting materials, ferro-electric behavior and materials parameters, magnetic properties of non-metallics, semi-conducting materials.

MAT 623 Theory and Structure of Metallic Materials. *Preq.: MAT 520. 3(3-0) F.* The metallic state, its atomic and electronic structure. Electron theory of metals and alloys. Advanced methods of determining electronic structure in metallic materials.

MAT 630 Phase Transformation in Materials II. *Preqs.: MAT 510, 530, 550. 3(3-0) F.* Formal theories of solid-solid transformations, transformation mechanisms, transformation morphologies.

MAT 631, 632 Advanced Physical Ceramics I, II. *Coreqs.: MAT 510, 610 or MAT 530, 630 or CE 511, 512 or PY 503, 552. 3(2-3) F,S.* Lattice structures and lattice energies in crystalline ceramics; relationships with elastic, optical and thermal properties. Effects of constitution and microstructure on lattice-sensitive properties. The defect crystalline state in ceramics; vacancies, color centers; dislocations, boundaries. Crystal growth. Plastic deformation processes, including creep and fatigue; the ductile-brittle transition. Structure-sensitive properties of crystalline, vitreous and composite ceramics; effects of constitution, microstructure and non-stoichiometry.

MAT 633 Advanced Mechanical Properties of Materials. *Preq.: MAT 630. 3(3-0) F.* The theories of yield strength, work hardening, creep, fracture and fatigue of crystalline materials will be developed in terms of dislocation theory.

MAT 661 Diffraction Theory. *Preq.: MAT 610. 3(3-0) F.* The diffraction of light, x-rays electrons and neutrons by matter is represented in Fourier space, and the known methods of generating the Fourier transform (usually atomic structure) are reviewed. Exploration, by high and low angle scattering techniques, of crystals, paracrystals, liquids, polydispersed aggregates and fibers. Feasibility of direct analysis by convolution integrals.

MAT 691, 692 Special Topics in Materials Engineering. *Preq.: Grad. standing. 1-3.* Special studies of advanced topics in materials engineering.

MAT 695 Materials Engineering Seminar. *1(1-0) F,S.* Reports and discussion of special topics in materials engineering and allied fields.

MAT 699 Materials Engineering Research. *Credits Arranged.* Independent investigation of an appropriate research problem. A report on this investigation is required as a graduate thesis.

Mathematics

GRADUATE FACULTY

Professor E. E. Burniston, Head

Professors: J. W. Bishir, S. L. Campbell, R. E. Chandler—*Graduate Administrator*, J. M. A. Danby, J. C. Dunn, R. O. Fulp, R. E. Hartwig, K. Koh, J. R. Kolb, J. Luh, J. A. Marlin, R. H. Martin Jr., C. D. Meyer, P. A. Nickel, C. V. Pao, E. L. Peterson, R. J. Plemmons, M. S. Putcha, N. J. Rose, H. Sagan, C. E. Siewert, E. L. Stitzinger, R. A. Struble, H. R. Van der Vaart, O. Wesler, J. B. Wilson; *Professors Emeriti:* R. C. Bullock, J. M. Clarkson, W. G. Dotson Jr., W. J. Harrington, J. Levine, H. M. Nahikian, H. V. Park, H. E. Speece, L. S. Winton; *Associate Professors:* L. O. Chung, J. D. Cohen, M. J. Evans, G. D. Faulkner, J. E. Franke, C. T. Kelley, T. J. Lada, D. M. Latch, J. M. Nelson Jr., L. B. Page, S. Schecter, J. F. Selgrade, R. Silber, M. F. Singer, W. M. Waters Jr., R. E. White; *Associate Professor Emeritus:* J. W. Querry; *Assistant Professors:* J. F. Charlton, D. W. Decker, D. E. Garoutte, D. J. Hansen, J. M. Mahaffy, M. A. Mostow, L. K. Norris, S. O. Paur, R. T. Ramsay, J. Rodriguez, E. W. Sachs, J. W. Silverstein, J. L. Sox Jr., D. F. Ullrich

The Department of Mathematics offers programs leading to the degrees of Master of Science and Doctor of Philosophy with a major in either mathematics or applied mathematics.

Applicants for admission should have an undergraduate degree in mathematics or its equivalent. This should include a year of mathematical analysis (or advanced calculus) and a year of modern algebra, including linear algebra. All applicants are requested to take the Graduate Record Examination including the Advanced Test in Mathematics.

A number of teaching assistantships are available. A student carrying a half-time assistantship is allowed to carry a course load of nine semester hours.

The requirements for the Master of Science degree include 36 semester hours of approved credits and a comprehensive examination. A master's project for 3 hours credit is required. Foreign languages are not required for the master's degree.

There is no prescribed minimum number of courses for the degree of Doctor of Philosophy. Normally a student will take approximately 60 semester hours of course credits including certain core courses in algebra, analysis and applied mathematics. Independent reading and participation in seminars constitute an indispensable part of the doctoral program.

All doctoral students are required to have a reading knowledge of two modern foreign languages. Comprehensive examinations are also required. These consist of a written examination designed to test basic knowledge and an oral examination on material related to the field of proposed thesis work.

The heart of the doctoral program is the dissertation. It must be original research resulting in a significant contribution in some area of mathematics or its applications and should be worthy of publication in the current literature. The doctoral dissertation must be defended at the final oral examination.

A detailed statement of requirements for graduate degrees is available on request from the graduate administrator.

SELECTED ADVANCED UNDERGRADUATE COURSES

MA 401 Applied Differential Equations II. *Preq.: MA 301. Credit for both MA 401 and MA 501 will not be given. 3(3-0) F,S,Sum.*

MA 403 Introduction to Modern Algebra. *Preq.: One year of calculus. 3(3-0) F,S,Sum.*

MA 405 Introduction to Linear Algebra and Matrices. *Preq.: One year of calculus. 3(3-0) F,S,Sum.*

MA 408 Foundations of Euclidean Geometry. *Preq.: MA 403. 3(3-0) F.*

MA 410 Theory of Numbers. *Preq.: One year of calculus. 3(3-0) S.*

MA 414 Introduction to Differential Geometry. *Preqs.: MA 202 and 405. 3(3-0) S.*

MA (CSC) 416 Introduction to Combinatorics. *Preq.: MA 403 or CSC 322. 3(3-0) F.*

MA 421 Introduction to Probability. *Preq.: One year of calculus. 3(3-0) F,S,Sum.*

MA 425 Mathematical Analysis I. *Preq.: MA 202 (MA 403 desirable). 3(3-0) F,S.*

MA 426 Mathematical Analysis II. *Preqs.: MA 425 and MA 405. 3(3-0) S.*

MA (CSC) 427 Introduction to Numerical Analysis I. *Preqs.: MA 301 and a programming language proficiency. 3(3-0) F.*

MA (CSC) 428 Introduction to Numerical Analysis II. *Preqs.: MA 405 and programming language proficiency. 3(3-0) S.*

MA 430 Mathematical Models in the Physical Sciences. *Preqs.: MA 301 and MA 405. 3(3-0) S.*

MA 432 Mathematical Models in Life Sciences and Social Sciences. *Preqs.: MA 301, MA 405; Coreq.: MA 421 or ST 371. 3(3-0) F.*

MA 433 History of Mathematics. *Preq.: One year of calculus. 3(3-0) F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

MA 501 Advanced Mathematics for Engineers and Scientists I. *Preq.: MA 301 or equivalent. Credit for this course and MA 401 is not allowed. 3(3-0) F,Sum.* Survey of mathematical methods for engineers and scientists. Ordinary differential equations and Green's functions; partial differential equations and separation of variables; special functions, Fourier series. Applications to engineering and science are stressed. This course cannot be taken for credit by mathematics majors.

MA 502 Advanced Mathematics for Engineers and Scientists II. *Preq.: MA 301 or equivalent. Any student receiving credit for MA 502 may receive credit for, at most, one of the following: MA 405, MA 512, MA 513. 3(3-0) S,Sum.* Determinants and matrices; line and surface integrals, integral theorems; complex integrals and residues; distribution functions of probability. This course cannot be taken for credit by mathematics majors.

MA (IE, OR) 505 Mathematical Programming I. *3(3-0) F,S.* (See industrial engineering.)

MA 507 Analysis for Secondary Teachers. *Preq.: Grad. standing. 3(3-0) Alt. F,Sum.* A course designed to update and broaden the secondary teacher's capability and point-of-view with respect to topics in analysis. Emphasis is upon the historical development, logical refinement and applications of concepts such as limits, continuity, differentiation and integration. This course may be taken for graduate credit for certificate renewal by secondary school teachers. Credit towards a graduate degree may be allowed only for students in mathematics education.

MA 508 Geometry for Secondary Teachers. *Preq.: Grad. standing. 3(3-0) Alt. S,Sum.* A course designed to study topics in geometry of concern to secondary teachers in their work and to provide background and enrichment. Various approaches to the study of geometry are investigated, including vector geometry, transformational geometry and axiomatics. This course may be taken for graduate credit and for certificate renewal by secondary school teachers. Credit towards a graduate degree may be allowed only for students in mathematics education.

MA 509 Abstract Algebra for Secondary Teachers. *Preq.: Grad. standing. 3(3-0) Alt. F,Sum.* A course designed to investigate from an advanced viewpoint topics in algebra from the high school curriculum. Emphasis is upon the theory of equations, polynomial rings, rational functions and elementary number theory. This course may be taken for graduate credit for certificate renewal by secondary school teachers. Credit towards a graduate degree may be allowed only for students in mathematics education.

MA 510 Selected Topics in Mathematics for Secondary Teachers. *Preq.: Grad. standing. 3(3-0) Alt. S,Sum.* A course designed to cover various topics in mathematics of concern to secondary teachers. Topics will be selected from areas such as mathematics of finance, probability, statistics, linear programming and theory of games, intuitive topology, recreational math, computers and applications of mathematics. This course may be taken for graduate credit for certification renewal by secondary school teachers. Credit towards a graduate degree may be allowed only by students in mathematics education.

MA 511 Advanced Calculus I. *Preq.: MA 301. 3(3-0) F,S,Sum.* Fundamental theorems on continuous functions; convergence theory of sequences, series and integrals; the Riemann integral.

MA 512 Advanced Calculus II. *Preq.: MA 301. 3(3-0) F,S,Sum.* General theorems of partial differentiation; implicit function theorems; vector calculus in 3-space; line and surface integrals; classical integral theorems.

MA 513 Introduction to Complex Variables. *Preq.: MA 202. 3(3-0) F,S,Sum.* Operations with complex numbers, derivatives, analytic functions, integrals, definitions and properties of elementary functions, multivalued functions, power series, residue theory and applications, conformal mapping.

MA 514 Methods of Applied Mathematics. *Preq.: MA 511 or 425. 3(3-0) S.* Introduction to integral equations, the calculus of variations and difference equations.

MA 515 Linear Functional Analysis I. *Preq.: MA 426. 3(3-0) F.* Metric spaces; Lebesgue measure and integration; L^p and l^p spaces; Riesz-Fischer and Riesz representation theorems; normed linear spaces and Hilbert spaces.

MA 516 Linear Functional Analysis II. *Preq.: MA 515. 3(3-0) S.* Basic theorems in Banach spaces, Basic theorems in Banach spaces, dual spaces, weak topologies; basic theorems in Hilbert spaces and detailed theory of linear operators on Hilbert spaces; spectral theorem for self-adjoint completely continuous linear operators.

MA 517 Introduction to Topology. *Preq.: MA 426. 3(3-0) F.* Sets and functions, metric spaces, topological spaces, compactness, separation, connectedness.

MA 518 Calculus on Manifolds. *Preq.: MA 426. 3(3-0) S.* Calculus of several variables from a modern viewpoint. Differential and integral calculus of several variables, vector functions, integration of manifolds, Stokes' and Green's theorems, vector analysis.

MA 520 Linear Algebra. *Preq.: MA 405. 3(3-0) F.* Vector spaces, linear mappings and matrices, determinants, inner product spaces, bilinear and quadratic forms, canonical forms, spectral theorem.

MA 521 Fundamentals of Modern Algebra. *Preqs.: MA 403 and 520. 3(3-0) S.* Groups, normal subgroups, quotient groups, Cayley's theorem, Sylow's theorem. Rings, ideals and quotient rings, polynomial rings. Fields, extension fields, elements of Galois theory.

MA 523 Topics in Applied Mathematics. *Coreqs.: MA 515, 520. 3(3-0) F.* Formulation of scientific problems in mathematical terms, interpretation and evaluation of the mathematical analysis of the resulting models. The course will discuss problems in behavioral and biological sciences as well as problems in mechanics of discrete and continuous systems. Some discussion of optimization and the calculus of variations.

MA 524 Mathematical Methods in the Physical Sciences I. *Preqs.: MA 405, 511 and either MA 401 or 501. 3(3-0) F.* Green's functions and two-point boundary value problems; elementary theory of distributions; generalized Green's functions. Finite and infinite dimensional inner product spaces; Hilbert spaces; completely continuous operators; integral equations; the Fredholm alternative; eigenfunction expansions; applications to potential theory. Nonsingular and singular Sturm-Liouville problems; Weil's theorem.

MA 525 Mathematical Methods in the Physical Sciences II. *Preq.: MA 524. 3(3-0) S.* Distribution theory in n -space; Fourier transforms; partial differential equations, generalized solutions, fundamental solutions, Cauchy problem, wave and heat equations, well-posed problems. Laplace's equation, the Dirichlet and Neumann problems, integral equations of potential theory, Green's functions, eigenfunction expansions.

MA (CSE) 529, 530 Numerical Analysis I, II. *Preqs.: (529) MA 405, MA 511 or equivalents, knowledge of a high level computing language; (530) MA 529. 3(3-0) F,S.* A practical survey of numerical analysis for graduate students in the engineering, physical and mathematical sciences. Topics chosen from: iterative methods for nonlinear equations, approximation theory, numerical solution of ordinary and partial differential equations, numerical linear algebra. Computing assignments illustrate algorithm behavior and applicability.

MA (E, OR) 531 Dynamical Systems and Multivariable Control. *3(3-0) F.* (See operations research.)

MA 532 Theory of Ordinary Differential Equations. *Preqs.: MA 301, 405, advanced calculus. 3(3-0) S.* Existence and uniqueness theorems, systems of linear equations, fundamental matrices, matrix exponential, series solutions, regular singular point; plane autonomous systems, stability theory.

MA 534 Introduction to Partial Differential Equations. *Preqs.: MA 425 or MA 511, MA 301. 3(3-0) F.* Theory of characteristics and classification of second order equations, existence, uniqueness and representation of solutions for the wave equation, Dirichlet and Neumann boundary-value problems for the Laplace equation, potential theory in two and higher dimensional domains, mean-value theorem and the maximum principle, Green's identities, initial boundary-value problems of heat equation and wave equation. Maximum principle of parabolic equation, method of eigenfunction expansions, Fourier series and Fourier transforms.

MA (CSE) 536 Theory of Sequential Machines. *Preq.: CSC 412 or grad. standing. 3(3-0) F.* Sequential machine identification experiments. Finite-Memory machines. Special classes of machines. Decomposition of sequential machines. Linear sequential machines. Sequential relations of finite-state machines.

MA (CSE) 537 Theory of Computability. *Preq.: CSC 412 or grad. standing. 3(3-0) S.* The concept of effective computability. Turing Machines. Primitive recursive functions. The μ operator. μ -recursive functions. Godel numbering. Equivalence of Turing Machines and μ -recursion. Undecidable predicates. Universal Turing Machines. Other formulations of the concept of effective computability.

MA (ST) 541 Theory of Probability I. *Preq.: MA 425 or 511. 3(3-0) F, Sum.* Axioms, combinatorial analysis, conditional probability, independence, random variables, expectation, special discrete and continuous distributions, probability and moment generating functions, central limit theorem, laws of large numbers, branching processes, recurrent events, random walk.

MA (ST) 542 Introduction to Stochastic Processes. *3(3-0) S.* (See statistics.)

MA 545 Set Theory and Foundations of Mathematics. *Preq.: MA 403. 3(3-0) S.* Logic and the axiomatic approach, the Zermelo-Fraenkel axioms and other systems, algebra of sets and order relations, equivalents of the Axiom of Choice, one-to-one correspondences, cardinal and ordinal numbers, the Continuum Hypothesis.

MA (PY) 555 Mathematical Introduction to Celestial Mechanics. *Preq.: MA 301. 3(3-0) F.* Central orbits, N -body problem, 3-body problem, Hamilton-Jacobi theory, perturbation theory, applications to motion of celestial bodies.

MA (PY) 556 Orbital Mechanics. *Preqs.: MA 301, 405, knowledge of elementary mechanics and computer programming. 3(3-0) S.* Keplerian motion, iterative solutions, numerical integration, differential corrections and space navigation, elements of probability, least squares, sequential estimation, Kalman filter.

MA (BMA, ST) 571 Biomathematics I. *3(3-0) F.* (See biomathematics.)

MA (BMA, ST) 572 Biomathematics II. *3(3-0) S.* (See biomathematics.)

MA 581 Special Topics. *Preq.: Consent of department. 1-6 F,S.*

MA (CSC) 582 Numerical Linear Algebra. *Preqs.: MA 405 or equivalent and a knowledge of computer programming. 3(3-0) F.* A mathematical and numerical investigation of direct, iterative and semi-iterative methods for the solution of linear systems. Methods for the calculation of eigenvalues and eigenvectors of matrices.

MA (CSC) 583 Numerical Solution of Ordinary Differential Equations. *Preq.: Knowledge to the level of CSC 427. 3(3-0) S.* Numerical methods for initial value problems including predictor-corrector, Runge-Kutta, hybrid and extrapolation methods; stiff systems; shooting methods for two-point boundary value problems; weak, absolute and relative stability results.

MA (CSC) 584 Numerical Solution of Partial Differential Equations—Finite Difference Methods. *Preqs.: MA 501; knowledge of a high level programming language. 3(3-0) F.* A survey of finite difference methods for partial differential equations including elliptic, parabolic and hyperbolic PDE's. Both linear and nonlinear problems are considered. Theoretical foundations are described; however, emphasis is placed on algorithm design and implementation.

MA (CSC, OR) 585 Graph Theory. 3(3-0) F. (See computer science.)

MA (IE, OR) 586 Network Flows. 3(2-2) S. (See industrial engineering.)

MA (CSC) 587 Numerical Solution of Partial Differential Equations—Finite Element Method. *Preqs.: MA 501; knowledge of a high level programming language.* 3(3-0) S. An introduction to the finite element method. Applications to both linear and nonlinear elliptic and parabolic partial differential equations. Theoretical foundations are described; however, emphasis is placed on algorithm design and implementation.

FOR GRADUATES ONLY

MA 600 Advanced Differential Equations I. *Preqs.: MA 513, 518, 520.* 3(3-0) F. (*Alt. years*). Analytical theory of ordinary differential equations, stability theory, perturbations, asymptotic behavior, nonlinear oscillations.

MA 601 Advanced Differential Equations II. *Preq.: MA 600.* 3(3-0) S. (*Alt. years*). Qualitative theory of ordinary differential equations, general properties of dynamical systems, limit sets, integral invariants, global theory.

MA 602 Partial Differential Equations I. *Preqs.: MA 426, 520, 532 or 600.* 3(3-0) F. (*Alt. years*). First order equations, initial value problems; theory of characteristics; existence and uniqueness theorems; hyperbolic equations.

MA 603 Partial Differential Equations II. *Preq.: MA 602.* 3(3-0) S. (*Alt. years*). Elliptic and parabolic equations; approximation methods; generalized solutions.

MA 604 Topology. *Preqs.: MA 515, 520.* 3(3-0) S. Topological spaces: separation axioms, compactness, connectedness, local topological properties; continuous mappings and convergence; product and quotient spaces; compactification; homotopy equivalence of mappings, fundamental groups, covering spaces, universal coverings, deck transformations.

MA 605 Homology and Manifolds. *Preq.: MA 604.* 3(3-0) F. Homology; either simplicial or singular theory, excision theorem, homotopy theorem, Mayer-Vietoris theorem and computation of groups, topology and geometry of differentiable manifolds, vector fields, Lie derivations and differential equations; smooth partitions of unity, integration, differential forms and Stokes' theorem; the DeRham cohomology and the DeRham theorem.

MA (ST, OR) 606 Mathematical Programming II. 3(3-0) S. (See statistics.)

MA (NE) 607 Exact and Approximate Solutions in Particle Transport Theory. 3(3-0) S. (See nuclear engineering.)

MA 611 Analytic Function Theory I. *Preq.: MA 426.* 3(3-0) F. A rigorous introduction to the theory of functions of a complex variable. The complex plane, functions, Mobius transformations, the exponential and logarithmic functions, trigonometric functions, infinite series, integration in the complex plane, Cauchy's theorem and its consequences.

MA 612 Analytic Function Theory II. *Preq.: MA 611.* 3(3-0) S. A continuation of MA 611. Taylor and Laurent series. The residue theorem, the argument principle, harmonic functions and the Dirichlet problem, analytic continuation and the monodromy theorem, entire and meromorphic functions, the Weierstrass product representation and the Mittag-Leffler partial fraction representation, special functions, conformal mapping and the Picard theorem.

MA 613 Techniques of Complex Analysis. *Preq.: MA 513 or 611.* 3(3-0) S. A course dealing with the applications of complex analysis to mathematical problems in physical science in the setting of the potential equation and other partial differential equations: contour in-

tegrals, special functions of mathematical physics from the line integral point of view, solution of problems in potential theory, asymptotic methods including WKB and Wiener-Hopf techniques.

MA (OR) 614 Integer Programming. *3(3-0) Alt. S.* (See operations research.)

MA 615 Theory of Functions of a Real Variable. *Preq.: MA 516. 3(3-0) S.* Real functions, semicontinuity, upper and lower limits, sequences; Lebesgue measure and integration, absolute continuity and differentiation.

MA (ST) 617, 618 Measure Theory and Advanced Probability. *3(3-0) F, S.* (See statistics.)

MA (ST) 619 Topics in Advanced Probability. *3(3-0) F.* (See statistics.)

MA 620 Modern Algebra I. *Preq.: MA 521. 3(3-0) Alt. F.* A study of groups, rings and modules. Elements of homology. Polynomials, Noetherian rings, Algebraic extensions, Galois theory.

MA 621 Modern Algebra II. *Preq.: MA 620. 3(3-0) Alt. S.* A study of linear maps, bilinear forms, representations, multilinear products, semisimplicity and the representation of finite groups.

MA 622 Linear Transformations and Matrix Theory. *Preq.: MA 405. 3(3-0) F.* Vector spaces, linear transformation and matrices, minimal polynomials, elementary divisors, canonical forms, quadratic forms, functions of matrices.

MA 623 Theory of Matrices and Applications. *Preq.: MA 520 or 622. 3(3-0) S.* Generalized inverses, matrix equation, variational methods for eigenvalues, matrix norms, perturbation of linear systems, computational methods, applications to differential equations, Markov chains.

MA 626 Algebraic Topology. *Preq.: MA 605. 3(3-0) Alt. S.* Simplicial and singular homology and cohomology, the Eilenberg-Steenrod axioms, duality, cohomology operations; higher homotopy groups, Hurewicz homomorphisms.

MA 628 General Topology. *Preq.: MA 604. 3(3-0) Alt. F.* Comparisons of topologies on function spaces; Ascoli theorems; Stone-Weierstrass theorems; uniform spaces and completions; paracompactness and partitions of unity; an introduction to a special topic such as topological vector spaces or topological groups.

MA (OR) 629 Vector Space Methods in System Optimization. *3(3-0) F.* (See operations research.)

MA 632 Operational Mathematics I. *Preq.: MA 513 or 611. 3(3-0) F.* Laplace transforms with theory and application to ordinary and partial differential equations arising from problems in engineering and physics.

MA 633 Operational Mathematics II. *Preq.: MA 632. 3(3-0) S.* Extended development of the Laplace and Fourier transforms and their application to the solution of ordinary and partial differential equations, integral equations and difference equations; Z-transforms, other infinite and finite transforms and their applications.

MA 634 Theory of Distributions. *Preq.: MA 632 or CI. 3(3-0) Alt. F.* Basic definitions and properties of testing functions and distributions in one or more variables, convergence and calculus of distributions, test functions of rapid descent and distributions of slow growth, convolution, Fourier transforms, applications in the area of differential and difference equations, etc.

MA 637 Differentiable Manifolds. *Preqs.: MA 405, 521; Coreq.: MA 604. 3(3-0) Alt. F.* An introduction to the topology and geometry of differentiable manifolds, multilinear algebra, exterior differential forms, differentiable manifolds, theory of connexions, Riemannian manifolds.

MA 641 Calculus of Variations and Theory of Optimal Control I. *Preqs.: MA 512 or 426, MA 532. 3(3-0) Alt. F.* Normed linear function spaces and Frechet differential, theory of the first variation, theory of fields and Weierstrass' excess function, Hamilton-Jacobi theory and dynamic programming, terminal control problems and the maximum principle.

MA 642 Calculus of Variations and Theory of Optimal Control II. *Preq.: MA 641. 3(3-0) Alt. S.* The homogeneous problem, the general control problem of Mayer, isoperimetric problems, theory of the second variation, existence of extrema, direct methods of the calculus of variations.

MA 647 Functional Analysis I. *Preq.: MA 516. 3(3-0) Alt. F.* Banach spaces; linear functionals; linear operators, uniform boundedness, open mapping and closed graph theorems; dual spaces; weak topologies.

MA 648 Functional Analysis II. *Preq.: MA 647. 3(3-0) Alt. S.* Advanced topics in functional analysis such as linear topological spaces; Banach algebra, spectral theory and abstract measure theory and integration.

MA 661 Differential Geometry and Tensor Analysis I. *Preq.: MA 426 or 512. 3(3-0) Alt. F.* Concepts of classical and modern differential geometry presented from the point of view of tensor analysis and differential forms. Topics to include: theory of curves, tensor analysis and differential forms, intrinsic geometry of surfaces, Riemannian geometry.

MA 662 Differential Geometry and Tensor Analysis II. *Preq.: MA 661. 3(3-0) Alt. S.* Continuation of MA 661.

MA (CSE) 679, 680 Advanced Numerical Analysis I, II. *Preqs.: (679) MA 515 and one of MA (CSE) 529, MA (CSC) 582, 583, 584, 587; (680) MA 679. 3(3-0) F,S.* Review of real analysis including multilinear algebra and topological vector spaces. Numerical solution of linear and nonlinear systems, eigenvalues and eigenvectors, approximation theory, quadrature, ordinary differential equations, optimization.

MA 681 Special Topics in Real Analysis. 1-6.

MA 682 Special Topics in Complex Analysis. 1-6.

MA 683 Special Topics in Algebra. 1-6.

MA 684 Special Topics in Combinatorial Analysis. 1-6.

MA 685 Special Topics in Numerical Analysis. 1-6.

MA 686 Special Topics in Topology. 1-6.

MA 687 Special Topics in Geometry. 1-6.

MA 688 Special Topics in Differential Equations. 1-6.

MA 689 Special Topics in Applied Mathematics. 1-6.

The subject matter in the special topics courses varies from year to year. The topics and instructors are announced well in advance by the department.

MA (IE, OR) 692 Special Topics in Mathematical Programming. 3(3-0) F,S,Sum. (See industrial engineering.)

MA 699 Research. Credits Arranged. Individual research in mathematics.

Mathematics and Science Education

For a listing of graduate faculty and departmental information, see mathematics and science education under education.

Mechanical and Aerospace Engineering

GRADUATE FACULTY

Professor R. A. Burton, Head

Professors: E. M. Afify, J. A. Bailey—*Graduate Administrator*, F. R. DeJarnette, J. A. Edwards, B. H. Garcia—*Assistant Head of the Department*, W. C. Griffith, F. J. Hale, F. D. Hart, H. A. Hassan, T. H. Hodgson, J. C. Mulligan, M. N. Ozisik, J. N. Perkins, L. H. Royster, F. O. Smetana, F. Y. Sorrell, J. K. Whitfield, C. F. Zorowski; *Visiting Professors:* M. M. Fikry, S. A. Jurovics; *Adjunct Professors:* R. L. Bradow, R. E. Fulton, E. A. Saibel; *Professors Emeriti:* M. H. Clayton, J. S. Doolittle, J. Woodburn; *Associate Professors:* M. A. Boles, T. A. Dow, A. C. Eberhardt, H. M. Eckerlin, R. R. Johnson, J. W. Leach, C. J. Maday, D. S. McRae, R. T. Nagel, W. F. Reiter Jr., J. S. Strenkowski; *Adjunct Associate Professors:* J. F. Campbell, P. B. Corson, D. M. Rao, R. E. Singleton, R. A. Whisnant; *Assistant Professors:* M. D. Bryant, R. F. Keltie, S. Torquato; *Adjunct Assistant Professor:* J. A. Daggerhart; *Visiting Lecturer:* J. S. Stewart

The Department of Mechanical and Aerospace Engineering offers graduate study leading to the Master of Mechanical Engineering, Master of Science and Doctor of Philosophy degrees. Entrance to the degree programs is based upon a pertinent, accredited baccalaureate degree.

Graduate study and research are available in the following areas:

(1) thermal sciences including classical and statistical thermodynamics, energy conservation and conversion, solar energy, alternative energy sources, heat and mass transfer and thermal pollution;

(2) sound and vibration technology including acoustic radiation, industrial and community noise control, transportation noise and hearing conservation, acoustic signal processing and computer vibration analysis;

(3) gas dynamics including subsonic, transonic, supersonic and hypersonic aerodynamics, lasers, plasmagasdynamics and combustion;

(4) computational fluid dynamics for inviscid flows, boundary layers and parabolized and complete Navier-Stokes equations for external and internal flows, grid generation;

(5) aerospace sciences including aeroelasticity, stability and control and aerospace propulsion;

(6) mechanical sciences including machine vibrations, mechanical transients, materials processing, photoelasticity and experimental stress analysis, finite element analysis and transportation systems and vehicle safety; automatic control of active structures; design optimization;

(7) mechanical design, precision engineering and tribology;

(8) computer-aided design with dedicated graphics work stations, advanced interactive software and a dedicated VAX 11/750 computer.

Extensive laboratory facilities include subsonic and supersonic wind tunnels; extensive sound and vibration laboratories including anechoic chambers, a large reverberation room, a machinery noise laboratory with field test and analysis instrumentation, a signal processing laboratory using a Data General AP130 Eclipse computer, a computer graphics and vibration analysis laboratory using a Nicolet 6602 structural analysis system and a Tektronix 4114 terminal for finite-element analysis, a materials processing laboratory; an experimental stress analysis and photoelasticity laboratory; an aeroelasticity laboratory; automotive performance and emission control facility; a solar energy storage laboratory; a heat transfer laboratory; and a precision engineering laboratory.

Computational facilities include VAX 11/750 and IBM 3081 computers, micro and array processors, minicomputers and terminals connected to the computational facilities at NASA Langley Research Center.

The objective of the department is to provide graduate education both in rigorous experimental and theoretical research training and practitioner-oriented engineering design.

SELECTED ADVANCED UNDERGRADUATE COURSES

MAE 403 Air Conditioning. *Preq.: MAE 302. 3(3-0) F.*

MAE 404 Refrigeration. *Preq.: MAE 302. 3(3-0) S.*

MAE 405 Mechanical Engineering Laboratory III. *Preq.: MAE 306. 1(0-3) F.*

MAE 406 Energy Conservation in Industry. *Preqs.: MAE 301 or 307; jr. or sr. status in engineering. 3(2-3) S.*

MAE 407 Steam and Gas Turbines. *Preqs.: MAE 302, MAE 308, or MAE 355. 3(3-0) S.*

MAE 408 Internal Combustion Engine Fundamentals. *Preq.: MAE 302. 3(3-0) F.*

MAE 409 Particulate Control in Industrial Atmospheric Pollution. *Preq.: MAE 301 or equivalent. 3(3-0) F.*

MAE 410 Convective Heat Transfer and Fluid Flow. *Preqs.: MAE 301, MAE 308. 3(3-0) F.*

MAE 411 Machine Component Design. *Preqs.: MAE 315, 316. 3(3-0) F.*

MAE 412 Energy Systems. *Preqs.: MAE 302, MAE 410. 3(3-0) S.*

MAE 415 Mechanical Engineering Analysis. *Preqs.: MAE 302, 315, 316, EE 331. 3(3-0) F.*

- MAE 416 Mechanical Engineering Design.** *Preqs.: MAE 302, 315, 316, EE 331. 4(3-2) S.*
- MAE 422 Direct Energy Conversion.** *Preqs.: MAE 301, EE 202 or 332. 3(3-0) S.*
- MAE 431 Thermodynamics of Fluid Flow.** *Preqs.: MAE 301, MA 301, MAE 308. 3(3-0) S.*
- MAE 435 Principles of Automatic Control.** *Preq.: MA 301. 3(3-0) F,S.*
- MAE 442 Automotive Engineering.** *Preq.: Sr. in Engineering. 3(3-0) S.*
- MAE 452 Aerodynamics of V/STOL Vehicles.** *Preq.: MAE 355. 3(3-0) F.*
- MAE 455 Boundary Layer Theory.** *Preq.: MAE 355. 3(3-0) F.*
- MAE 462 Flight Vehicle Stability and Control.** *Preqs.: MAE 261, 435. 3(3-0) F.*
- MAE 465 Propulsion II.** *Preq.: MAE 365. 4(3-3) F.*
- MAE 472 Aerospace Vehicle Structures II.** *Preq.: MAE 371. 4(3-3) S.*
- MAE 478 Aerospace Vehicle Design I.** *Preqs.: MAE 356, 472; Coreqs.: MAE 462, 465. 2(2-0). F.*
- MAE 479 Aerospace Vehicle Design II.** *Preq.: MAE 478. 3(1-6) S.*
- MAE 495 Special Topics in Mechanical and Aerospace Engineering.** *1-3 F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

- MAE 501 Advanced Engineering Thermodynamics.** *Preqs.: MAE 302; MA 401 or MA 511. 3(3-0) F.* Thermodynamics of a general reactive system; conservation of energy and the principles of increase of entropy; the fundamental relation of thermodynamics; Legendre transformations; equilibrium and stability criteria in different representation; general relations; chemical thermodynamics; multi-reaction system; ionization; irreversible thermodynamics; the Onsager relation; applications to thermoelectric, thermomagnetic and diffusional processes.
- MAE 502 Advanced Energy Systems.** *Preq.: MAE 401. 3(3-0) S.* An engineering examination of energy sources, both conventional and proposed. Review of existing energy conversion systems and a critical examination of advanced systems, such as magnetohydrodynamics, fuel cells, solar, geothermal, wind, tides, thermal gradients in oceans and the hydrogen economy.
- MAE 503 Advanced Power Plants.** *Preq.: MAE 401. 3(3-0) F.* A critical analysis of the energy balance of thermal power plants, thermodynamics and economic evaluation of alternate schemes of development; study of recent development in the production of power.
- MAE 504 Fluid Dynamics of Combustion I.** *Preqs.: MAE 301, MAE 355 or MAE 308. 3(3-0) F.* Gas-phase thermochemistry including chemical equilibrium and introductory chemical kinetics. Homogeneous reaction phenomena. Subsonic and supersonic combustion waves in premixed reactants (deflagration and detonation). Effects of turbulence. Introduction to diffusion flame theory.
- MAE 505 Heat Transfer Theory and Applications.** *Preq.: MAE 402 or equivalent. 3(3-0) F.* Development of basic equations for steady and transient heat and mass transfer processes. Emphasis is placed on the application of the basic equations to engineering problems in the areas of conduction, convection, mass transfer and thermal radiation.

MAE 506 Advanced Automotive Energy Systems. *Preq.: MAE 408. 3(3-0) S.* A critical study of the various cycles and energy systems for automotive transportation is carried out. The feasibility of automotive Rankine cycle power plants, Sterling engines, gas turbines and hydrogen-air fueled engines are discussed. Means of improving the efficiency and exhaust emissions of internal combustion engines and the use of alternative fuel sources are considered.

MAE 510 Effects of Noise and Vibration on Man. *Preqs.: Sr. standing in Engineering, MA 301. 3(3-0) Alt. F.* Study of the effects of noise and vibration on man. Topics covered include acoustic and vibration fundamentals, auditory and non-auditory response to noise, subjective response to noise, environment noise, body physical characteristics, effects of vibration and shock exposure.

MAE 513 Vibration of Mechanical and Structural Components. *Preq.: MAE 315 or 472; Coreq.: MA 511. 3(3-0) F.* Modeling of mechanical and structural systems for vibration analysis and presentation of exact and approximate solution techniques. Techniques of vibration control are presented and experience on the digital computer is provided.

MAE 514 Industrial Noise Control. *Preq.: MAE 315. 3(2-3) S.* Provides definition of the industrial noise problem, development of analytical problem solving skills, introduction to instrumentation, involvement in design project, laboratory demonstrations.

MAE 517 Instrumentation in Sound and Vibration Engineering. *Preq.: ECE 331; Coreq.: MAE 513. 3(3-0) F.* This course is devoted to a presentation of measurement techniques and the theory and operation of transducers and amplifiers. An introduction to signal analysis techniques such as power spectral density and correlation is also provided.

MAE 518 Acoustic Radiation I. *Preqs.: MA 301 and MAE 308 or MAE 356. 3(3-0) F.* An introduction to the principles of acoustic radiation from vibrating bodies and their related fields. The radiation of simple sources, the propagation of sound waves in confined spaces and transmission through different media are considered.

MAE 519 Theory of Noise in Transportation Systems. *Preq.: MAE 550. 3(3-0) S.* A study of the basic noise generating mechanisms encountered in transportation systems. Coverage includes jet noise, propeller noise, helicopter noise, fan and compressor noise, aircraft induced community noise, surface vehicle noise models and efforts to control noise in transportation systems.

MAE 525 Advanced Flight Vehicle Stability and Control. *Preq.: MAE 462. 3(3-0) F.* Preliminary analysis and design of flight control systems to include autopilots and stability augmentation systems. Study of effects of inertial cross-coupling and nonrigid bodies on vehicle dynamics.

MAE 526 Inertial Navigation Analysis and Design. *Preq.: MAE 435 or 462. 3(3-0) S.* Performance analysis and engineering design of inertial navigation components, subsystems and systems. Development of transfer functions and application of linear system techniques to determine stability, transient response and errors of gyroscopes, accelerometers, stable platforms and inertial alignment systems. Error analysis and its significance. Preliminary analysis and design of typical inertial navigation systems for aircraft and marine vehicles.

MAE (MAT) 531 Materials Processing by Deformation. *Preq.: Six hours of solid mechanics and/or materials. 3(3-0) F.* The course involves a presentation of the mechanical and metallurgical fundamentals of materials processing by deformation. Topics to be discussed include: principles of metal working, friction, forging, rolling, extrusion, drawing, high energy rate forming, chipless forming techniques, manufacturing system concept in production.

MAE (MAT) 532 Fundamentals of Metal Machining Theory. *Preq.: Six hours of solid mechanics and/or materials. 3(3-0) S.* The course involves a presentation of the mechanical and metallurgical fundamentals of metal machining. Topics to be discussed include: mechanics of machining, temperatures generated, tool life and tool wear, lubrication, grinding process, electrical machining processes, surface integrity, economics, nomenclature of cutting tools.

MAE 533 Finite Element Analysis of Mechanical and Aeronautical Systems I. *Preq.: MAE 472; Coreq.: MAE 415. 3(3-0) S.* Concepts and applications of the finite element method for stress and deformation analysis. Explanation and application of a general purpose finite element program for stress and deformation analysis of simple structures and load-carrying components.

MAE 534 Finite Element Analysis of Mechanical and Aeronautical Systems II. *Preq.: MAE 533. 3(3-0) F.* This course extends the finite element study, initiated in MAE 533, for stress analysis to other fields of interest in mechanical and aerospace engineering. Topics considered include vibration and frequency analysis, heat transfer and potential flow. Two topics of advanced stress analysis, thin shells and the bending of plates, are also included.

MAE 535 Experimental Stress Analysis. *Preq.: MAE 316 or 371. 3(2-3) F.* Theoretical and experimental techniques of strain and stress analysis with emphasis on electrical strain gages and instrumentation, brittle coatings, grid methods and an introduction to photoelasticity. Laboratory includes an investigation and complete report of a problem chosen by the student under the guidance of the instructor.

MAE 536 Photoelasticity. *Preq.: MAE 316 or 371. 3(2-3) S.* Theory and experimental techniques of two- and three-dimensional photoelasticity including photoelastic coatings, photoplasticity and an application of photoelastic methods to the determination of stress-strain distributions in loaded members. Laboratory includes an investigation and complete report of a problem chosen by the student under the guidance of the instructor.

MAE 540 Advanced Air Conditioning Design. *Preqs.: MAE 403, 404. 3(3-0) F.* The design of heating and air-conditioning systems; the preparation of specifications and performance tests on heating and air-conditioning equipment.

MAE 541 Advanced Machine Design I. *Preq.: MAE 416. 3(3-0) F.* An advanced integrated treatment of stress analysis and materials engineering devoted to current rational methods of analysis and design applicable to mechanical components. Primary attention placed on the determination and prediction of strength, life and deformation characteristics of machine components as dictated by performance requirements.

MAE (OR) 545 Variational Methods in Optimization Techniques I. *3(3-0) Alt. F,S.* (See operations research.)

MAE 550 Foundations of Fluid Dynamics. *Preqs.: MAE 301, MAE 355 or MAE 308. 3(3-0) F.* Review of basic thermodynamics pertinent to gas dynamics. Detailed development of the general equations governing fluid motion in both differential and integral forms. Simplification of the equations to those for specialized flow regimes. Similarity parameters. Applications to simple problems in various flow regimes.

MAE 551 Airfoil Theory. *Preq.: MAE 355. 3(3-0) S.* Development of fundamental aerodynamic theory. Emphasis upon mathematical analysis and derivation of equations of motion, airfoil theory and comparison with experimental results. Introduction to supersonic flow theory.

MAE 552 Transonic Aerodynamics. *Preq.: MAE 356. 3(3-0) S.* A detailed study of the latest theoretical and experimental findings in transonic aerodynamics, including two-dimensional and axisymmetric flows.

MAE 553 Compressible Fluids. *Preq.: MAE 356 or MAE 431 or MAE 550. 3(3-0) Alt. F.* Equations of motion in supersonic flow. Prandtl-Meyer turns, method of characteristics, hodograph plane, supersonic wind tunnels, supersonic airfoil theory and boundary layer shock interaction.

MAE 554 Hypersonic Aerodynamics. *Preq.: MAE 356. 3(3-0) F.* A detailed study of the latest theoretical and experimental findings in hypersonic aerodynamics.

MAE 555 Aerodynamic Heating. *Preq.: MAE 356. 3(3-0) F.* A detailed study of the latest theoretical and experimental findings of the compressible laminar and turbulent boundary layers with special attention to the aerodynamic heating problem. Application of theory in the analysis and design of aerospace hardware.

MAE 556 Mechanics of Ideal Fluids. *Preq.: MAE 355 or MAE 308. 3(3-0) S.* Fundamental principles of fluid dynamics. Mathematical methods of analysis are emphasized. Potential flow theory development with introduction to the effects of viscosity and compressibility. Two-dimensional and three-dimensional phenomena are considered.

MAE 557 Dynamics of Internal Fluid Flow. *Preq.: MAE 356 or MAE 308. 3(3-0) F.* A general development of the governing equations of fluid motion with subsequent restriction to incompressible flow. Exact and approximate solutions of the Navier-Stokes equations for internal laminar flow and elementary boundary layer theory. Applications include: hydrodynamic lubrication, converging-diverging channel flows, entrance flows and turbulent internal flow.

MAE 558 Plasmagasdynamics I. *Preqs.: MAE 356, PY 414. 3(3-0) F.* Study of basic laws governing plasma motion for dense and rarefied plasmas, hydromagnetic shocks, plasma waves and instabilities, simple engineering applications.

MAE 559 Molecular Gas Dynamics I. *Preq.: MAE 550. 3(3-0) F.* Statistical mechanics as applied to the derivation of the equations of gas dynamics from the microscopic viewpoint. Collision processes, treatments of viscosity, heat conduction and electrical conductivity.

MAE (MEA) 563 Geophysical Fluid Mechanics. *3(3-0) Alt. F.* (See marine, earth and atmospheric sciences.)

MAE (ECE) 565 Gas Lasers. *Preqs.: MAE 356 or equivalent, PY 407. 3(3-0) F.* Study of the principles, design and potential application of ion, molecular, chemical and atomic gas lasers.

MAE 570 Theory of Particulate Collection in Air Pollution Control. *Preq.: MAE 409 or grad. standing. 3(3-0) S.* Particulate matter is classified and its properties are described. The motion of particles as applied to particulate collection is carefully analyzed. The elements of aerodynamic capture of particles are developed and applications in filtration and liquid scrubbing are considered. Fundamentals of acoustical, electrostatic and thermal precipitation are introduced. Sampling techniques and instrumentation are also considered.

MAE 586 Project Work in Mechanical Engineering. *1-6 F,S.* Individual or small group investigation of a problem stemming from a mutual student-faculty interest. Emphasis is placed on providing a situation for exploiting student curiosity.

MAE 589 Special Topics in Mechanical Engineering. *Preq.: Advanced undergrad. or grad. standing. 3(3-0) F,S.* Faculty and student discussions of special topics in mechanical engineering.

FOR GRADUATES ONLY

MAE 601 Statistical Thermodynamics. *Preq.: MAE 501. 3(3-0) S.* Fundamental principles of kinetic theory, quantum mechanics, statistical mechanics and irreversible phenomena with particular reference to thermodynamics systems and processes. The conclusions of classical thermodynamics are analyzed and established from the microscopic viewpoint.

MAE 603 Advanced Direct Energy Conversion. *Preq.: MAE 501. 3(3-0) F.* An engineering study of the modern developments in the field of conversion of heat to power in order to meet new technology demands. Thermoelectric, thermomagnetic, thermionic, photovoltaic and magneto-hydrodynamic effects and their utilization for energy conversion purposes, static and dynamic response, limitations imposed by the first and second laws of thermodynamics. Energy and entropy balances, irreversible sources, inherent losses, cascading, design procedures, experimental studies to determine the response and efficiency of various systems.

MAE 604 Fluid Dynamics of Combustion II. *Preq.: MAE 504. 3(3-0) S.* Advanced theory of detonation and deflagration. Ignition criteria. Direct initiation of detonation including blast-wave theory. Transition from deflagration to detonation. Combustion wave structure and stability. Liquid droplet and solid particle combustion.

MAE 608 Advanced Conductive Heat Transfer. *Preq.: MAE 505. 3(3-0) F.* A generalized treatment of the solution of transient and steady heat conduction in finite and infinite regions. Approximate and exact methods of solution of problems involving phase change, variable thermal properties and non-linear boundary conditions. Heat conduction in composite media and in anisotropic solids.

MAE 609 Advanced Convective Heat Transfer. *Preq.: MAE 557. 3(3-0) S.* Advanced topics in steady and transient, natural and forced convective heat transfer for laminar and turbulent flow through conduits and over surfaces. Mass transfer in laminar and turbulent flow is also covered. Topics on compressible flow with heat and mass transfer are included.

MAE 610 Advanced Radiative Heat Transfer. *Preq.: MAE 505. 3(3-0) S.* A comprehensive and unified treatment of basic theories; exact and approximate methods of solution of radiative heat transfer and the interaction of radiation with conductive and convective modes of heat transfer in participating and non-participating media.

MAE 614 Mechanical Transients and Machine Vibrations. *Preq.: MAE 513. 3(3-0) S.* Forces and motions produced in mechanical systems by periodic transient inputs including shock and impact loading. Application to lumped mass and continuous systems including plates and shells.

MAE 615 Nonlinear Vibrations. *Preq.: MAE 513. 3(3-0) S.* A study of free and forced vibrations of non-linear systems with non-linear restoring forces and self-sustained oscillations. Various analytical and phase plane methods are developed and used in obtaining actual solutions. Emphasis is placed on understanding properties unique to non-linear systems.

MAE 618 Acoustic Radiation II. *Preq.: MAE 518. 3(3-0) S.* Advanced treatment of the theory of sound generation and transmission. Topics include: techniques for solution of the wave equation, radiation from spheres, cylinders and plates, sound propagation in ducts, scattering.

MAE 619 Random Vibration. *Preq.: MAE 513. 3(3-0) F.* Mathematical description of stochastic processes. The stationary and ergodic assumptions and response analysis of mechanical systems to random excitation. Simulation of and failure due to random environments.

MAE 623 Mechanics of Machinery. *Preqs.: MAE 315, MA 512. 3(3-0) F.* Advanced applications of dynamics to the design and response analysis of dynamic behavior of machines and mechanical devices. Emphasis on developing competence in transforming real problems in dynamics into appropriate mathematical models whose analysis permits performance predictions of engineering value.

MAE 640 Advanced Machine Design II. *Preqs.: MAE 541 and CI. 3(3-0) S.* A continuation, at the advanced level, of MAE 541, Advanced Machine Design I.

MAE 642 Mechanical Design Analysis. *Preq.: Nine hours of graduate credit in MAE. 3(3-0) F.* Lecture and project activity devoted to development of the ability to apply knowledge and experience in performing comprehensive design analysis of complete mechanical systems. Areas of interest to include critical problem recognition, system modeling, performance determination and optimization and reliability evaluation.

MAE 643 Mechanical Design Synthesis. *Preq.: MAE 642. 3(2-2) S.* Application of the basic philosophy and methodology of the complete design process to advanced mechanical system design. Individual and group experience in the conception, synthesis, analysis, optimization and implementation phases of feasibility, preliminary and final design studies; provided by means of comprehensive system design projects.

MAE (OR) 646 Variational Methods in Optimization Techniques II. *3(3-0) Alt. F,S.* (See operations research.)

MAE 654 Dynamics of Real Fluids I. *Preq.: MAE 550 or 557. 3(3-0) S.* Exact solutions to the Navier-Stokes equations. Approximate solutions for low Reynolds numbers. Approximate solutions for high Reynolds numbers—incompressible boundary layer theory. Laminar and turbulent boundary layers in theory and experiment. Flow separation.

MAE 655 Dynamics of Real Fluids II. *Preq.: MAE 654. 3(3-0) F.* A continuation of MAE 654. Compressible laminar and turbulent boundary layers. Laminar and turbulent jets. The stability of laminar boundary layers with respect to small disturbances, transition from laminar to turbulent flow.

MAE 656 Turbulence. *Preq.: MAE 550. 3(3-0) S.* A development of the basic concepts and governing equations for turbulence and turbulent field motion. Formulations of the various correlation tensors and energy spectra for isotropic and nonisotropic turbulence. An introduction to turbulent transport processes, "free" turbulence, and "wall" turbulence.

MAE 658 Plasmagasdynamics II. *Preq.: MAE 558. 3(3-0) S.* Quantum statistics and ionization phenomena. Charged particle interactions. Transport properties in the presence of electric and magnetic fields and nonequilibrium ionization.

MAE 659 Molecular Gas Dynamics II. *Preqs.: MAE 559, 601. 3(3-0) S.* A continuation of MAE 559. Approximate methods of solution to the Boltzmann equation. Modeling of the Boltzmann equation. Results obtained by the various methods of analysis.

MAE 661 Introduction to Rocket Propulsion. *Preq.: MAE 501. 3(3-0) F.* Review of the exterior ballistics and performance of rocket-propelled vehicles. Thermodynamics of real gases at high temperatures. Nonequilibrium flow in rocket nozzles.

MAE 662 Chemical Propulsion. *Preq.: MAE 661. 3(3-0) S.* *this course will cover solid or liquid propellant rockets, and deal* Depending upon student interest, with combustion of propellants, combustion instabilities and the design and performance of solid or liquid propellant engines.

MAE (MEA) 663 Advanced Geophysical Fluid Mechanics. 3(3-0) *Alt. S.* (See marine, earth and atmospheric sciences.)

MAE (MEA) 664, 665 Perturbation Method in Fluid Mechanics I, II. 3(3-0) *F.S.* (See marine, earth and atmospheric sciences.)

MAE 686 Advanced Topics in Mechanical Engineering. *Preq.: Grad. standing. 1-3 F.S.* Faculty and graduate student discussions of advanced topics in contemporary mechanical engineering.

MAE 695 Mechanical Engineering Seminar. 1(1-0) *F.S.* Faculty and graduate student discussions centered around current research problems and advanced engineering theories.

MAE 699 Mechanical Engineering Research. *Preqs.: Grad. standing in mechanical engineering, consent of adviser. Credits Arranged.* Individual research in the field of mechanical engineering.

Microbiology

GRADUATE FACULTY

Professor J. B. Evans, Head

Professors: W. J. Dobrogosz, G. H. Elkan, J. J. Perry; *Adjunct Professor:* R. E. Kanich; *Associate Professors:* R. E. Johnston, G. H. Luginbuhl, J. M. Mackenzie Jr., T. Melton; *Associate Professor (USDA):* P. E. Bishop; *Adjunct Associate Professor:* D. H. King

ASSOCIATE MEMBERS OF THE DEPARTMENT

Professors: P. B. Hamilton, W. E. Kloos, J. G. Lecce; *Associate Professors:* E. V. DeBuysscher, H. M. Hassan; *Assistant Professor:* W. G. Dougherty

The Department of Microbiology offers programs leading to the Master of Science and Doctor of Philosophy degrees. These are research oriented programs that require a dissertation based on personal research. For students wishing a more general education without the thesis requirement, the Master of Life Sciences degree is offered with an emphasis in microbiology.

Applicants should have a bachelor's degree in one of the biological or physical sciences including at least one course in microbiology and courses in organic chemistry and calculus. Deficiencies may be made up while in graduate school but will not be counted as credit toward a graduate degree.

There are no specific departmental requirements regarding courses of study. There is a core of basic courses in microbiology that will be in the programs of most graduate students who have not had equivalent courses previously. As many as half of the courses in most programs will be basic courses in related areas such as biochemistry, chemistry, genetics or toxicology.

At least one semester of half-time teaching experience is required of all Ph.D. candidates. All graduate students are expected to attend and participate in the seminar program every semester they are in residence. As a general rule the M.S.

program requires two full years (including summers) beyond the B.S. level and the Ph.D. program requires two or three full years beyond the M.S. level.

SELECTED ADVANCED UNDERGRADUATE COURSES

MB 401 General Microbiology. *Preqs.: BS 100; CH 223 or CH 220. 4(3-3) F,S.*

MB (FS) 405 Food Microbiology. *Preq.: MB 401. 3(2-3) F.*

MB 411 Medical Microbiology. *Preq.: MB 401. 4(3-3) S.*

MB 490 Special Studies in Microbiology. *Preqs.: Three courses in MB and CI. 1-3 F,S,Sum.*

MB 491 Seminar in Microbiology. *Preq.: Jr. standing. 1(1-0) F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

MB 501 A,B,C Advanced Microbiology I (A-Metabolism; B-Physiology; C-Immunology). *Preq.: MB 401. 1-3 F.* Basic concepts and principles of three major areas of microbiology presented as a series of five-week minicourses: MB 501A, metabolism; MB 501B, physiology; MB 501C, immunology. Graduate students majoring in microbiology must take all sections or have equivalent knowledge. Others may enroll for specific minicourses.
Dobrogosz, Hassan, Lecce

MB 502A,B,C Advanced Microbiology II (A-Systematics; B-Virology; C-Pathogenesis). *Preq.: MB 401. 1-3 S.* Basic concepts and principles of three major areas of microbiology presented as a series of five-week minicourses: MB 502A, systematics; MB 502B, virology; MB 502C, pathogenesis. Graduate students majoring in microbiology must take all sections or have equivalent knowledge. Others may enroll for specific minicourses.
Evans, Johnston, Luginbuhl

MB 503 Microbial Ecology. *Preq.: MB 401. 3(2-3) F.* An integrated treatment of all aspects of biological changes in habitats brought about by microorganisms. The physiological and biochemical approach will be stressed.
Elkan

MB (FS) 506 Advanced Food Microbiology. *3(1-6) S.* (See food science.)

MB 511 Industrial Microbiology. *Preqs.: BCH 451 and MB 401. 1(1-0) S.* Concepts, principles and procedures involved in the industrial production of useful chemicals by microbial fermentation. Screening methods for selection and evaluation of inoculum cultures, the potential role of genetic engineering and practical considerations in implementing a profitable fermentation process will be discussed, with examples from currently operational fermentations.
Perry

MB 514 Microbial Metabolic Regulation. *Preqs.: MB 401, BCH 451 or BCH 551. 3(3-0) S.* An integrative perspective on bacterial physiology and metabolism through an analysis of metabolic regulatory functions.
Dobrogosz

MB (SSC) 532 Soil Microbiology. *4(3-3) S.* (See soil science.)

MB 551 Immunology I. *Preq.: MB 401. 3(2-2) F.* A concise study of the basic concepts and principles in immunology and serology. Primary emphasis will be on humoral immunity involving soluble blood and lymph components important in the resistance of the host to disease.
DeBuysscher, Tonkonogy

MB (PO, PHY) 552 Immunobiology. 3(2-3) S. (See poultry science.)

MB (ZO) 555 Protozoology. 4(2-6) S. (See zoology.)

MB (BAE, CE) 570 Sanitary Microbiology. 3(2-3) S. (See civil engineering.)

MB 571 Molecular Biology of Animal Viruses. *Preqs.: BCH 551, MB 401.* 3(3-0) F. Animal virus replication. Selected examples from each virus group illustrate the principles underlying lytic, persistent and tumor-inducing viral infection. Johnston

MB (BO) 574 Phycology. 3(1-4) S. (See botany.)

MB (BO, PP) 575 The Fungi. 3(3-0) F. (See botany.)

MB (BO, PP) 576 The Fungi—Lab. 1(0-3) F. (See botany.)

MB 590 Topical Problems. *Preqs.: Grad. standing, CI. Credits Arranged.* F,S.

Graduate Staff

FOR GRADUATES ONLY

MB (SSC) 632 Ecology and Functions of Soil Microorganisms. 3(3-0) S. (See soil science.)

MB 690 Microbiology Seminar. 1(1-0) F,S.

Graduate Staff

MB 692 Special Problems in Microbiology. *Credits Arranged.* F,S,Sum.

Graduate Staff

MB 699 Microbiology Research. *Credits Arranged.* F,S,Sum.

Graduate Staff

Nuclear Engineering

GRADUATE FACULTY

Professor P. J. Turinsky, *Head*

Professors: R. P. Gardner, R. F. Saxe, E. Stam, C. E. Siewert, K. Verghese—
Graduate Administrator; *Professors Emeriti:* R. L. Murray, L. R. Zumwalt;
Associate Professors: J. G. Gilligan, K. L. Murty; *Adjunct Associate Professor:*
D. L. Hillis; *Assistant Professor:* J. M. Doster

The discipline of nuclear engineering is concerned with the development of nuclear processes for energy production and with the applications of radiation for the benefit of society. The Department of Nuclear Engineering offers graduate study via courses and research leading to the Master of Nuclear Engineering, Master of Science and Doctor of Philosophy degrees.

Representative topics of investigation include nuclear reactor safety, nuclear systems' thermal-hydraulics, nuclear reactor and transport theory, fuel management, reactor kinetics and noise analysis, nuclear power plant simulator modelling, radiation detection and measurement, properties of nuclear materials and radiation effects, fusion engineering and applications of radioisotopes and radiation in industry, medicine and science.

The department's one-megawatt PULSTAR reactor, which became operational in 1973, is similar in design, type of fuel and performance to modern power reactors. It is used for teaching, research and service in behalf of the University. Also available for student use in research are radiation detection laboratories, NAA laboratory, nuclear materials laboratory, prompt gamma facility, neutron radiography unit, NMR facility noise analysis equipment, IBM Model 3081 computer, VAX/730 minicomputer, many microcomputers and several other well-equipped laboratories.

Bachelor's degree graduates in any of the fields of engineering or physical sciences may be qualified for successful advanced study in nuclear engineering. Prior experience or course work in nuclear physics, differential equations and basic reactor analysis is helpful but may be gained during the first semester of graduate study.

Teaching assistantships, research assistantships and fellowships are available for qualified applicants. Opportunities are also available for graduate co-op work with utility companies and reactor manufacturers in the Raleigh area, providing a valuable combination of financial support and learning in the classroom, the research laboratory and on the job.

Thirty semester hours are required for the Master of Nuclear Engineering and M.S. degrees. Students may also work directly toward a Ph.D. degree. Interdisciplinary programs with other departments in the School of Engineering and the School of Physical and Mathematical Sciences are available.

The advent of competitive nuclear power and the ever-increasing need for reliable clean energy has created a strong demand for nuclear engineers to participate in all phases of the nuclear power field—environmental studies, siting, design, construction, testing, operation, licensing and evaluation. Graduates of the department find positions in industry, government and educational institutions, working with reactors in the several categories—thermal, fast breeder and fusion.

SELECTED ADVANCED UNDERGRADUATE COURSES

NE 401 Reactor Analysis and Design. *Preq.: C or better in NE 302. 4(3-2) S.*

NE 402 Reactor Engineering. *Preqs.: NE 302, MA 401. 4(3-2) F.*

NE 403 Nuclear Engineering Design Projects. *Preqs.: NE 401, NE 402. 3(2-3) S.*

NE 404 Radiological, Reactor, and Environmental Safety. *Preq.: NE 302 or NE 419. 3(3-0) S.*

NE 405 Reactor Systems. *Preq.: NE 402. 3(3-0) F.*

NE 407 Reactor Operations Engineering. *Preq.: NE 302 or NE 419. 3(2-3) F.*

NE (MAT) 409 Nuclear Materials. *Preq.: MAT 201. 2(2-0) S.*

NE 412 Nuclear Fuel Cycles. *Preq.: NE 302. 3(3-0) S.*

NE 414 Nuclear Power Plant Instrumentation. *Preqs.: NE students—ECE 331, 332; ECE students—NE 419. 3(3-0) S.*

NE 419 Introduction to Nuclear Engineering. *Preq.: PY 202 or PY 208. 3(3-0) F.*

NE 491 Special Topics in Nuclear Engineering. *Preq.: CI. 1-4 F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

NE 501 Radiation and Reactor Fundamentals. *Preq.: MA 401; Coreq.: NE 419. 4(3-3) F.*
An introduction to fundamentals of reactor physics, nuclear radiation and radiation interactions. Topics include radiation interaction with matter, radiation detection, neutron and reactor physics, neutron slowing down, one-group and two-group criticality for bare and reflected reactors and radiation shielding. Laboratory experiments in radiation detection and attenuation are included. Stam

NE 502 Nuclear Engineering Analysis. *Preqs.: NE 401 or NE 501, MA 401. 3(3-0) S.*
Provides a unified view of the basic equations and techniques of radiation transport calculations. The course introduces the common analytical and numerical solution techniques used in nuclear engineering and develops solutions for typical problems in the nuclear field. The course is intended to provide the background in analysis needed for more advanced studies in nuclear engineering. Doster, Gardner

NE 503 Reactor Analysis. *Preqs.: NE 401 or NE 501; MA 401. 2(2-0) F.* Provides the basic theory of neutron motion and methods for finding neutron flux distributions in a nuclear reactor. Neutron slowing, resonance absorption, thermalization and diffusion in reactor components are emphasized. With the knowledge of the contents of the course students can read the literature, perform analysis and do calculations. Verghese

NE 504 Reactor Heat Transfer. *Preq.: NE 501. 2(2-0) S.* Considers heat generation and transfer in nuclear power reactors. Topics include reactor heat generation, steady-state heat flow in fuel elements, unsteady-state heat transfer, convective heat transfer coefficients for turbulent flow, boiling and two-phase flow, reactor system descriptions and reactor economics. Doster, Turinsky

NE 505 Reactor Dynamics and Control. *Preq.: NE 401 or NE 501. 2(2-0) F.* Considers the time dependent behavior of nuclear reactors and their control. Topics include time dependent, one-speed diffusion equation, point reactor kinetics, solutions for ramp insertions of reactivity, temperatures and void coefficients, feedback in power excursions, feedback analysis reactor transfer functions, determination of transfer functions, digital reactivity meters and space dependent reactor dynamics. Saxe

NE 506 Radioisotopes Measurement Applications. *Preqs.: MA 401, NE 501. 2(2-0) S.* Introduces the student to measurement application using radioisotopes. In addition to surveying all tracer and gauging applications and radiography, four major specific applications in gauging and tracing are treated in detail. Gardner, Verghese

NE 507 Radiation Effects. *Preq.: NE 401 or NE 501. 2(2-0) F.* Introduces the student to radiation effects on organic materials, metals and inorganic solids with particular emphasis on nuclear reactor fuels. Applications of radiation effects such as sterilization and polymerization are discussed as well as the implications of radiation damage to reactor materials. Murty

NE 508 Radiation Safety. *Preq.: NE 501. 2(2-0) S.* Presents the basic concepts of health physics, biological effects of radiation and calculation of radiation exposure. Methods of dose reduction are considered with particular emphasis on radiation shielding. Topics include: radiation units, allowable radiation exposures, dose calculations—external and internal, radiation dosimetry, reactor radiation sources and shielding. Stam

NE 510 Nuclear Design Calculations. *Preqs.: NE 401 or NE 501. 3(3-0) S.* Application of the digital computer to problems in reactor core design. Available reactor core physics computer modules are studied and exercised. Systems and programs used by industry for power reactor core design and follow are described. A review of relevant numerical methods facilitates computer program development by the students. Turinsky

NE (PY) 511 Nuclear Physics for Engineers. *3(3-0) F.* (See physics.)

NE 514 Principles of Fusion Reactors. *Preqs.: NE 503, NE 507. 3(3-0) S.* Provides an introduction to plasma concepts and fusion reactor design. Topics include: basics of thermonuclear reactions, plasma confinement, formation and heating of plasmas, reactor concepts and designs, materials problems and environmental effects. Gilligan

NE (MAT) 562 Materials Problems in Nuclear Engineering. *3(3-0) F.* (See materials engineering.)

NE (MAT) 573 Computer Experiments in Materials and Nuclear Engineering. *3(3-0) S.* (See materials engineering.)

NE (CE) 574 Environmental Consequences of Nuclear Power. *Preqs.: CI. 3(3-0) S.* Evaluation of environmental consequences resulting from electrical power generation, with emphasis on siting, construction and operation of nuclear power plants. Topics include: growth in electrical demand, alternative sources of power and their environmental aspects; fuel reprocessing; sources and treatment of solid, liquid and gaseous wastes; sources and effects of waste heat; federal and state regulations, including Environmental Impact Statements. Kohl, Smallwood

NE 591, 592 Special Topics in Nuclear Engineering I, II. *Preqs.: CI. 3(3-0) F,S.*
Graduate Staff

FOR GRADUATES ONLY

NE 601 Reactor Theory and Analysis. *Preqs.: NE 502, NE 503, CI. 3(3-0) F.* Theoretical aspects of neutron diffusion and transport related to the design computation and performance analysis of nuclear reactors. Principal topics are a unified view of the neutron cycle including slowing, resonance capture and thermalization; reactor dynamics and control; fuel cycle studies; and neutron transport methods. Background is provided for research in power and test reactor analysis. Turinsky

NE (MA) 607 Exact and Approximate Solutions in Particle Transport Theory. *Preqs.: MA 501 or MA 511. 3(3-0) S.* The method of elementary solutions is used to solve exactly basic problems in neutron-transport theory and related topics. In addition, the F_N method is developed and used to establish concise approximate solutions in the realm of particle transport theory. Siewert

NE 611 Radiation Detection. *Preqs.: NE 501, NE 506, CI. 3(2-2) F.* Covers the advanced aspects of radiation detection such as computer methods applied to gamma-ray spectroscopy, absolute detector efficiencies by experimental and Monte Carlo techniques, the use and theory of solid state detectors, time-of-flight detection experiments and Mossbauer and other resonance phenomena. Gardner, Verghese

NE 620 Nuclear Radiation Attenuation. *Preqs.: NE 502, NE 508, CI. 3(3-0) F.* The physical theory and mathematical analysis of the penetration of neutrons, gamma-rays and charged particles. Analytical techniques include point kernels, transport theory, Monte Carlo and numerical methods. Digital computers are employed in the solution of practical problems. Doster, Siewart

NE 621 Radiation Effects on Materials. *Preqs.: NE 507, CI. 3(3-0) F.* Interactions of radiation with matter, with emphasis on the physical effects. Current theories and experimental techniques are discussed. Annealing of defects, radiation induced changes in physical properties and effects in reactor materials are discussed. Murty

NE 622 Transport of Matter in Nuclear Reactors. *Preqs.: NE 507, CI. 3(3-0) S.* Mechanisms of fission product migration in reactor solids and fluids. Emphasis is on absorption phenomena, thermodynamics of reversible processes, diffusion mathematics and experimental methods. Zumwalt

NE 631 Reactor Kinetics and Control. *Preqs.: NE 505, CI. 3(3-0) S.* A study of the control of nuclear reactor systems. Basic control theory is developed including the use of Bode, Nyquist and S-plane diagrams and state-variable methods. Reactor and reactor systems are analyzed by these methods and control methods and optimum-control methods are developed. Models for reactors and reactor-associated units, such as heat exchangers, are discussed. The effects of non-linearities are presented. Saxe

NE 641 Radioisotopes Applications. *Preqs.: NE 506, CI. 3(3-0) F.* Principles and techniques of radioisotope applications are presented. Topics include radiotracer principles, radiotracer applications to engineering processes, radioisotope gauging principles and charged particle, gamma ray and neutron radioisotope gauges. Gardner, Verghese

NE 653 Power Plant Engineering and Safety Analysis. *Preqs.: NE 504, 505, 3(3-0) F.* Detailed discussion of project engineering, safety analysis licensing and regulations that pertain to the procurement and operation of nuclear power systems. Turinsky

NE 691, 692 Advanced Topics in Nuclear Engineering I, II. *Preq.: CI. 3(3-0) F, S.* A study of recent development in nuclear engineering theory and practice. Graduate Staff

NE 695 Seminar in Nuclear Engineering. *1(1-0) F, S.* Discussion of selected topics in nuclear engineering. Graduate Staff

NE 699 Research in Nuclear Engineering. *Preq.: Grad. standing. Credits Arranged.* Individual research in the field of nuclear engineering. Graduate Staff

Nutrition

GRADUATE FACULTY

Professor H. A. Ramsey, *Coordinator*

Professors: L. W. Aurand, A. J. Clawson, R. E. Cook, W. E. Donaldson, R. W. Harvey, C. H. Hill, H. N. Jacobson, W. L. Johnson, E. E. Jones, C. A. Lassiter, J. M. Leatherwood, J. G. Lecce, D. R. Lineback, R. D. Mochrie, A. H. Rakes, H. A. Ramsey, H. E. Swaisgood, S. B. Tove; *Professors Emeriti:* E. R. Barrick, F. H. Smith, G. H. Wise; *Extension Professor Emeritus:* E. S. Cofer; *Associate Professors:* G. L. Catignani, J. D. Garlich, J. J. McNeill, J. C. H. Shih; *Assistant Professors:* W. J. Croom, J. W. Spears

Graduate study leading to either a Master of Science or a Doctor of Philosophy degree in nutrition may be taken in the interdepartmental nutrition program. Participating departments include animal science, biochemistry, food science and poultry science. Students reside and conduct research in one of these departments

under the direction of an appropriate advisor. Co-majors involving a participating department or related discipline are permitted. Minors may be biochemistry, microbiology, physiology, statistics or other approved graduate field.

Research in the nutrition program is conducted with a variety of species and at levels ranging from the molecular to the whole animal. The approach, therefore, is frequently both fundamental and comparative. Research facilities in each department are extensive and the problems under investigation are many and varied. Additional information about the program may be obtained by writing to Dr. H. A. Hamsey, Coordinator, Nutrition Program, P.O. Box 5127, North Carolina State University, Raleigh, North Carolina 27650.

SELECTED ADVANCED UNDERGRADUATE COURSES

NTR (ANS, PO) 415 Comparative Nutrition. *Preq.: CH 220 or both 221 and 223. 3(3-0) F.*

NTR (ANS) 419 Human Nutrition in Health and Disease. *Preqs.: BCH 451 and either NTR 415 or FS 400. 3(3-0) S.*

Associated courses related to nutrition are:

FS 400 Foods and Nutrition. *Preq.: CH 220. 3(3-0) Alt. S.*

FS 402 Food Chemistry. *Preq.: CH 220 or CH 221. 3(2-3) F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

NTR (ANS) 516 Quantitative Nutrition. *Preq.: BCH 451 or NTR (ANS) 415. 3(1-6) S.* The quantitative evaluation of dietary ingredients and the determination of nutrient utilization. Exploration of the quantitative principles of nutrition through the use of laboratory animals and microorganisms. Johnson

NTR (ANS) 540 Ruminant Physiology and Metabolism. *3(3-0) F.* (See animal science.)

NTR 590 Topical Problems in Nutrition. *Preq.: Grad. or sr. standing. 1-6 F,S.* Analysis of current problems in nutrition. Also entails the scientific appraisal and solution of a selected problem designed to provide training and experience in research. Graduate Staff

FOR GRADUATES ONLY

NTR 601 Protein and Amino Acid Metabolism. *Preqs.: BCH 551, ZO 421, a 400-level nutrition course. 3(3-0) S.* Protein and amino acid metabolism, regulation, dietary requirements and techniques for their investigation in human and other animals are studied. Garlich

NTR (ANS, PO) 605 Mineral Metabolism. *3(3-0) F.* (See animal science.)

NTR (FS) 606 Vitamin Metabolism. *Preqs.: ANS (NTR, PO) 415 and BCH 551. 2(2-0) F.* Structures, chemical and physical properties, functions, deficiency symptoms, distribution, absorption, transport, metabolism, storage, excretion and toxicity of the vitamins in humans and domestic animals. Nutritional significance of the essential fatty acids and the metabolism of prostaglandins, prostacyclins and leucotrienes.

Catignani, Garlich, Jones, Tove

NTR 608 Energy Metabolism. *Preqs.: BCH 551 and an introductory NTR course. 3(3-0) F.* This course relates biochemical and physiological events within the cell, tissue, organ and system with the nutrient needs as sources of energy for productive animal life. Digestion, absorption and metabolism of energy sources will be discussed. Processes of energy transformations within living structures will be presented in relation to free energy, biological oxidations, coupled reactions, anabolic and catabolic systems, metabolic control and efficiency.

Leatherwood

NTR 690 Advanced Special Problems in Nutrition. *Preq.: Grad. standing. 1-6 F,S.* Directed research in a specialized phase of nutrition designed to provide experience in research methodology and philosophy.

Graduate Staff

NTR 699 Research in Nutrition. *Preq.: Grad. standing. Credits Arranged. F,S.* Original research preparatory to the thesis for the Master of Science or Doctor of Philosophy degree.

Graduate Staff

Occupational Education

For a listing of graduate faculty and departmental information, see occupational education under education.

Operations Research

GRADUATE FACULTY

Professor S. E. Elmaghraby, Chairman and Program Director

Professors: B. B. Bhattacharyya, J. W. Bishir, W. Chou, J. C. Dunn, W. S. Galler, H. J. Gold, T. J. Hodgson, D. F. McAllister, B. M. Olsen, E. L. Peterson, S. Stidham Jr.; Associate Professors: H. A. Devine, C. L. Dyer, C. J. Maday, A. A. J. Nilsson, H. L. W. Nuttle, T. W. Reiland, W. J. Stewart; Assistant Professors: J. E. Richards, C. D. Savage

Operations research is a graduate program of a multidisciplinary nature, governed by an administrative board and the program committee, and administered through the office of the program director.

The program offers the degrees of Master of Science and Doctor of Philosophy. Both are research degrees requiring a thesis. A foreign language is not required at the master's level and is optional with the student's advisory committee at the doctoral level. A brochure is available which describes in more detail the requirements for both degrees.

An advanced program of study in operations research implies intensive study in at least two of the following areas: mathematical optimization, dynamical systems and control theory, stochastic systems, econometrics and economic decision theory and information and cybernetics.

For students who wish to combine their study in OR with studies in another field, the program offers a joint program at the Ph.D. level with computer studies and others at the M.S. level with computer science and with management. Further-

more, the OR program encourages co-majoring with mathematics, statistics or any field of science and engineering. Please consult the OR brochure for more details.

SELECTED ADVANCED UNDERGRADUATE COURSE

OR 493 Special Topics in Operations Research. *Preqs.: Jr. or sr. standing; MA 112. 1-3 F,S,Sum.*

CENTRAL COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

OR 501 Introduction to Operations Research. *Preqs.: MA 421 or ST 421 or ST 371 and ST 372. 3(3-0) F,S.* OR Approach: modeling, constraints, objective and criterion. The problem of Multiple criteria. Optimization, Model validation. The team approach. Systems Design. Examples, OR Methodology: mathematical programming; optimum seeking; simulation, gaming; heuristic programming. Examples. OR Applications; theory of inventory; economic ordering under deterministic and stochastic demand. The production smoothing problem; linear and quadratic cost functions. Waiting line problems: single and multiple servers with Poisson input and output. The theory of games for two-person competitive situations. Project management through PERT-CPM. Elmaghraby

OR (IE, MA) 505 Mathematical Programming I. *Preq.: MA 405. 3(3-0) F,S.* A study of mathematical methods applied to problems of planning. Linear programming will be covered in detail. This course is intended for those who desire to study this subject in depth and detail. It provides a rigorous and complete development of the theoretical and computational aspects of this technique as well as a discussion of a number of applications. Peterson

OR 506 Algorithmic Methods in Nonlinear Programming. *Preqs.: MA 301, MA 405, knowledge of computer language, such as FORTRAN or PL1. 3(3-0) S.* Introduction to methods for obtaining approximate solutions to unconstrained and constrained minimization problems of moderate size. Emphasis on geometrical interpretation and actual coordinate descent, steepest descent, Newton and quasi-Newton methods, conjugate gradient search, gradient projection and penalty function methods for constrained problems. Specialized problems and algorithms will be treated as time permits. Reiland

OR (IE) 509 Dynamic Programming. *Preqs.: MA 405, ST 421. 3(3-0) S.* An introduction to the theory and computational aspects of dynamic programming and its application to sequential decision problems. Elmaghraby, Stidham

OR 520 Theory of Activity Networks. *Preqs.: OR 501, OR (IE, MA) 505. 3(3-0) Alt. S.* Introduction to graph theory and network theory. A discussion in depth of the theory underlying (1) deterministic activity networks (CPM): optimal time-cost trade offs; the problem of scarce resources; (2) probabilistic activity networks (PERT): critical evaluation of the underlying assumptions; (3) generalized activity networks (GERT, GAN): applications of signal flow graphs and semi-Markov process to probabilistic branching; relation to the theory of scheduling. Elmaghraby

OR (CHE) 527 Optimization of Engineering Processes. *Preqs.: CHE 451 or OR 501, FORTRAN programming. 3(3-0) F.* The formulation and solution of process optimization problems, with emphasis on nonlinear programming techniques. Computer implementation of optimization algorithms and structuring of process models to increase computational efficiency. Felder

OR (E, MA) 531 Dynamical Systems and Multivariable Control. *Preqs.: MA 301, 405 or equivalent. 3(3-0) F.* Introduction to analytical modeling, control and optimization of

dynamical systems based on state space and transfer function descriptions. Emphasis on linear, continuous-time and discrete-time systems. Topics include state variables, transforms, flow graphs, canonical forms, system response, stability, controllability and observability, modal control, non-interacting control, observers, fundamental concepts of optimal control and estimation. Multidisciplinary applications chosen from biological, chemical, economic, electrical, mechanical and sociological systems. Dunn

OR (MAE) 545 Variational Methods in Optimization Techniques I. *Preqs.: MA 511, MA 512. 3(3-0) Alt. F.* Variational methods are applied to optimization problems in engineering, where examples are drawn from flight mechanics, operations research, heat transfer, structures and aerodynamics. The necessary conditions which follow from the general variation of a functional are developed. Solutions with corners and discontinuities are considered. Inequality constraints on control variables and constrained extrema are also considered. Gradient methods are described. Maday

OR (IE) 561 Queues and Stochastic Service Systems. *Preq.: MA 421. 3(3-0) F.* General concepts of stochastic processes are introduced. Poisson processes, Markov processes, and renewal theory are presented. These are then used in the analysis of queues, starting with a completely memoryless queue to one with general parameters. Applications to many engineering problems will be considered. Nilsson, Stidham

OR (CSC, CSE, ECE, IE) 562 Advanced Topics in Computer Simulation. *3(3-0) F.* (See computer studies.)

OR (CSC, MA) 585 Graph Theory. *Preq.: MA 231 or 405. 3(3-0) F.* Basic concepts of graph theory. Trees and forests. Vector spaces associated with a graph. Representation of graphs by binary matrices and list structures. Traversability. Connectivity. Matchings and assignment problems. Planar graphs. Colorability. Directed graphs. Applications of graph theory with emphasis on organizing problems in a form suitable for computer solution. Savage

OR (IE, MA) 586 Network Flows. *Preq.: OR (IE, MA) 505 or equivalent. 3(2-2) Alt. S.* This course will study problems of flows in networks. These problems will include the determination of the shortest chain, maximal flow and minimal cost flow in networks. The relationship between network flows and linear programming will be developed as well as problems with nonlinear cost functions, multi-commodity flows and the problem of network synthesis. Nuttle

OR 591 Special Topics in Operations Research. *Preq.: CI. 1-3 F,S,Sum.* Individual or small group studies of special areas of OR which fit into the students' programs of study and which may not be covered by other OR courses. Furthermore, the course serves as a vehicle for introducing new or specialized topics at the introductory graduate level. Graduate Staff

FOR GRADUATES ONLY

OR (CSC) 605 Large Scale Linear Programming Systems. *Preqs.: OR 505 and FOR-TRAN programming experience. 3(3-0) Alt. S.* A study of the specialized algorithms for the efficient solution of large scale LP problems. Includes: parametric programming, bounded variable algorithms, generalized upper bounding, decomposition, separable programming and mixed integer programming. Emphasis is on gaining firsthand practical experience with current computer codes and computational procedures. McAllister

OR (MA, ST) 606 Mathematical Programming II. *Preq.: OR (IE, MA) 505. 3(3-0) S.* This course provides an advanced mathematical treatment of the analytical and algorithmic aspects of finite dimensional nonlinear programming. It includes an examination of the structure and effectiveness of computational methods for unconstrained and constrained minimization. Special attention will be directed toward current research and recent developments in the field. Peterson, Reiland

OR 609 Advanced Dynamic Programming. *Preqs.: OR 509, MA 541. 3(3-0) Alt. F.* Introduction to measure theoretic concepts, review of finite state Markov processes, theory of Markovian programming, discrete decision processes, continuous time dynamic programming, relation to calculus of variation and the Maximum Principle. Emphasis throughout is on recent theoretical development in the field. (Offered in alt. years.)

Elmaghraby, Stidham

OR (MA) 614 Integer Programming. *Preqs.: MA 405, OR (MA, IE) 505; Coreq.: Some familiarity with computers (e.g., CSC 111). 3(3-0) Alt. S.* Study of general integer programming problems and principal methods of solving them. Emphasis on intuitive presentation of ideas underlying various algorithms rather than detailed description of computer codes. The students will have some "hands on" computing experience that should enable them to adapt the ideas presented in the course to integer programming problems they may encounter.

Graduate Staff

OR (MA) 629 Vector Space Methods in System Optimization. *Preqs.: MA 405, 511 or equivalent. 3(3-0) F.* Introduction to algebraic and function-analytic concepts used in system modeling and optimization: vector space, linear mappings, spectral decomposition, adjoints, orthogonal projection, quality, fixed points and differentials. Emphasis on geometric insight. Topics include least square optimization of linear systems, minimum norm problems in Banach space, linearization in Hilbert space, iterative solution of system equations and optimization problems. Broad range of applications in operations research and system engineering including control theory, mathematical programming, econometrics, statistical estimation, circuit theory and numerical analysis.

Dunn

OR (MAE) 646 Variational Methods in Optimization Techniques II. *Preq.: OR (MAE) 545. 3(3-0) Alt. S.* Variational methods are applied to optimization problems in engineering, where examples are drawn from flight mechanics, operations research, heat transfer, structures and aerodynamics. The necessary conditions which follow from the general variation of a functional are developed. Solutions with corners and discontinuities are considered. Inequality constraints on control variables and constrained extrema are also considered. Gradient methods are described.

Maday

OR (E) 650 Algorithmic Methods in Optimal Control. *Preq.: OR 629 or equivalent; Coreq.: Knowledge of higher level language (e.g., FORTRAN or PL1). 3(3-0) Alt. S.* Study of computational methods for optimal control of dynamical systems. Emphasis on extensions of nonlinear programming to control problems described by differential and difference equations. Topics include linear systems with quadratic objective, gradient and dynamic programming algorithms for nonlinear control problems, methods for treating control and state constraints, and an introduction to optimization of delay and distributed parameter systems. The course will include computational exercises based on applications from OR and engineering.

Dunn

OR 691 Special Topics in Operations Research. *Preqs.: OR 501, OR (IE, MA) 505. 3(3-0) F,S,Sum.* The purpose of this course is to allow individual students or small groups of students to take on studies of special areas in OR which fit into their particular program and which may not be covered by other OR courses. The work will be directed by a qualified faculty member and in some instances by visiting professors. The subject matter in any year is dependent on the students and the faculty members.

Graduate Staff

OR (IE, MA) 692 Special Topics in Mathematical Programming. *Preqs.: OR (IE, MA) 505. 3(3-0) F,S,Sum.* The study of special advanced topics in the area of mathematical programming. New techniques and current research in this area will be discussed. The faculty responsible for this course will select according to their preference and interest the areas to be covered during the semester. This course will not necessarily be taught by an individual faculty but can, on occasion, be a joint effort of several faculty members from this University as well as visiting faculty from other institutions. To date, courses on Theory of

Networks, Optimal Control Algorithms and Integer Programming have been offered under the umbrella of this course. It is anticipated that these topics will be repeated in the future, together with other topics. Graduate Staff

OR 695 Seminar in Operations Research. *Preq.: Enrollment in OR as a major or minor. 1(1-0) F,S.* and reports. Graduate students with minors or majors in operations research are expected to attend throughout the period of their residence. Graduate Staff

OR 699 Project in Operations Research. *Preq.: Variable. 1-3 F,S,Sum.* Individual research by graduate students minoring and majoring in operations research. Research may be done under the operations research faculty member meeting the interest need of the student. Graduate Staff

SUGGESTED COGNATE COURSES

Cognate courses in the operations research program are courses often included in programs of study but which carry other departmental designations. They cover subject matter closely related to operations research and provide additional insight into the basis or application of operations research techniques. Students should not assume they will be able to include any of the cognate courses in their own program of study unless they have made previous arrangements with their faculty advisor.

Biomathematics

BMA (MA, ST) 571, 572 Biomathematics I & II

Chemical Engineering

CHE 525 Chemical Process Control

Civil Engineering

CE 575 Civil Engineering Systems

Computer Science

CSE (MA) 529, 530 Numerical Analysis I, II

CSC (MA) 582 Numerical Linear Algebra

CSC (MA) 583 Numerical Solution of Ordinary Differential Equations

CSC (MA) 584 Numerical Solution of Partial Differential Equations—Finite Difference Methods

Economics and Business

EB 650 Economic Decision Theory

EB (ST) 651 Econometrics

EB (ST) 652 Topics in Econometrics

Electrical and Computer Engineering

ECE 516 System Control Engineering

ECE (CSE) 521 Digital Computer Technology and Design

ECE 613 Advanced Feedback Control

ECE 642 Automata and Adaptive Systems

Industrial Engineering

- IE 523 Production Planning, Scheduling and Inventory Control
 IE 611 The Design of Production Systems
 IE 622 Inventory Control Methods II

Mathematics

- MA (ST) 541 Theory of Probability I
 MA (ST) 542 Introduction to Stochastic Processes
 MA (ST) 617, 618 Measure Theory and Advanced Probability
 MA (ST) 619 Topics in Advanced Probability
 MA 622 Linear Transformations and Matrix Theory
 MA 641, 642 Calculus of Variations and Theory of Optimal Control I & II
 MA 685 Special Topics in Numerical Analysis

Statistics

- ST 583 Introduction to Statistical Decision Theory
 ST 613, 614 Time Series Analysis I & II

Pest Management**GRADUATE FACULTY**

Associate Professor Blanche C. Haning, *Program Coordinator*

Professors: C. W. Averre III, R. C. Axtell, M. K. Beute, J. R. Bradley Jr., W. M. Brooks, G. A. Carlson, H. D. Coble, F. T. Corbin, E. B. Cowling, H. J. Gold, S. F. Jenkins Jr., W. M. Lewis, L. T. Lucas, C. E. Main, T. J. Monaco, R. L. Robertson, G. C. Rock, D. C. Sanders, T. J. Sheets, P. B. Shoemaker, R. E. Stinner, J. W. Van Duyn, A. D. Worsham; *Professor (USDA):* R. A. Reinert; *Extension Professor:* W. A. Skroch; *Adjunct Professor:* L. Thompson Jr.; *Professor Emeritus:* R. L. Rabb; *Associate Professors:* C. S. Apperson, J. S. Bacheler, E. J. Dunphy, F. P. Hain, G. G. Kennedy, J. R. Meyer, D. P. Schmitt, T. B. Sutton, C. G. Van Dyke, M. Wann; *Assistant Professors:* J. T. Ambrose, J. J. Arends, J. E. Bailey, R. I. Bruck, F. Gould, W. J. Lamont Jr., M. M. Peet, E. B. Poling, G. J. San Julian, P. S. Southern

The concept of integrated pest management (IPM) combines the theoretical and practical aspects of cultural, biological and chemical control into effective systems that maintain pest populations at levels that minimize economic and environmental damage. This approach and its implementation are opening new career opportunities for broadly informed individuals who understand the basic biology and ecology of pests and the systems with which they are associated.

Graduate study in integrated pest management draws upon faculty from several departments, especially plant pathology, entomology, crop science and horticultural science. The Integrated Pest Management Teaching Subcommittee establishes the general requirements. Each student's advisory committee must include a graduate faculty member from the Pest Management faculty. All programs must have the approval of the chairman of the IPM Teaching Subcommittee.

A graduate minor in pest management emphasizing agricultural crops is available for the Master of Science degree. This minor provides students with an understanding of the theory, purpose and practice of integrated pest management. Required courses or their equivalents are PM 415, Principles of Pest Management; PM 490, Pest Management Seminar or PM 595, Topical Problems in Integrated Pest Management, and at least one graduate level course each in plant pathology, entomology and weed science. A course in ecology is also recommended. This plan can also be accommodated in the Master of Agriculture degree program.

Additionally, a concentration in pest management is available within the Master of Agriculture degree and is identified by "Pest Management" on the transcript. This concentration involves a minimum of 36 credit hours and allows interdisciplinary programs of study tailored to students' needs. It includes graduate course work from at least four closely related disciplines and a minimum 3-month internship in the field. Opportunities for teaching and observing or cooperating in research are available. In the crop production and protection area the following courses or their equivalents are required: PP 515, Epidemiology and Plant Disease Control; ENT 562, Agricultural Entomology; CS(HS) 514, Principles and Methods in Weed Science; SSC 541, Soil Fertility. Deficiencies in basic course work in the crop and pest disciplines including integrated pest management will be taken in addition to these minimum requirements. Graduate students enrolled in this program are located in the department of their major professor and participate in departmental activities, including seminar.

Additional information may be obtained by contacting a member of the Graduate Faculty or the Program Coordinator, Pest Management Program, P.O. Box 50328, North Carolina State University, Raleigh, North Carolina 27650-6328.

SELECTED ADVANCED UNDERGRADUATE COURSES

PM 415 Principles of Pest Management. *Preqs.: ENT 312, PP 315, BO (ZO) 360: Coreq.: CS 414. 4(3-3) F.*

PM 490 Pest Management Seminar. *Preq.: PM 415. 2(1-1) S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

PM (BO, CS, ENT, PP) 525 Biological Control. *Preqs.: CS 414, ENT 312 or 425, PP 315. 4(3-3) Alt. F.* An interdisciplinary examination of the taxonomic and biological relationships of parasites, predators and pathogens of insects, weeds and plant pathogens, including their regulatory roles resulting from their occurrence either naturally in the environment or through human intervention.
Brooks, Stinner, Van Dyke

PM 590 Advanced Topics in Integrated Pest Management. *Preq.: PM 405 or PM 415. 1-6 F,S,Sum.* Directed studies in Integrated Pest Management. Provides opportunity for advanced students to increase their understanding of current IPM philosophy, literature, research and technology through instruction or work experience in the field.

Graduate Staff

PM 595 Topical Problems in Integrated Pest Management. *Preq.: PM 415. 2(1-2) S.* One weekly lecture followed by discussions and projects relating to current topics in integrated pest management (IPM) under the guidance of interdisciplinary faculty teams; improves understanding of the depth and complexities of IPM and opportunities and limitations for its implementation.
Haning

Students are advised to review course listings in such relevant departments as animal science, crop science, economics and business, entomology, horticultural science, plant pathology and soil science and the School of Forest Resources.

Physics

GRADUATE FACULTY

Professor R. R. Patty, Head

Professors: K. T. Chung, W. R. Davis, W. O. Doggett, C. R. Gould, G. L. Hall, A. W. Jenkins Jr., C. E. Johnson, G. H. Katzin, G. Lucovsky, E. R. Manning, J. D. Memory, G. E. Mitchell—*Associate Head of the Department and Graduate Administrator*, J. Y. Park, J. F. Schetzina, L. W. Seagondollar, D. R. Tilley, A. W. Waltner; *Professors Emeriti:* W. H. Bennett, J. T. Lynn, A. C. Menius Jr.; *Associate Professors:* C. M. Armstrong, G. C. Cobb, S. R. Cotanch, D. G. Haase, M. A. Klenin, F. Lado, D. H. Martin, J. R. Mowat, G. W. Parker, J. S. Risley, D. E. Sayers; *Adjunct Associate Professors:* T. S. Dunn, W. P. Kirk II; *Assistant Professors:* J. W. Cook Jr., K. L. Johnston, M. A. Paesler; *Adjunct Assistant Professor:* R. K. Parker

ASSOCIATE MEMBERS OF THE DEPARTMENT

Professors: J. M. A. Danby, R. E. Fornes, D. L. Ridgeway

Study in physics is available leading to the degrees of Master of Science and Doctor of Philosophy. In addition to the areas of research listed below, thesis work may also be done in closely related departments in the fields of biophysics, environmental sciences, nuclear reactor theory and computer science. Available to the department are the computer facilities (including the IBM System 370/165 computer) of the nearby Triangle Universities Computation Center which is jointly operated by Duke University, the University of North Carolina at Chapel Hill and North Carolina State University. These three universities also jointly staff the Triangle Universities Nuclear Laboratory located on the Duke campus. The major facilities are a 15 MeV model FN Tandem Van De Graaff accelerator with a 15 MeV cyclotron injector and on-line computer facilities.

Experimental and theoretical research is being performed in atmospheric physics, atomic and molecular physics, nuclear magnetic resonance, nuclear physics, plasma physics and solid state physics. Theoretical work is in progress in relativity and general field theory and in statistical theory.

Programs of study leading to the Master of Science degree require a minimum of 30 semester hours; a thesis is required.

The Doctor of Philosophy degree is granted on successful completion of examinations, independent research and the submission of an acceptable dissertation. A minor area of study is required.

A large number of teaching and research assistantships is available. An out-of-state student holding such an assistantship may be eligible for reduced tuition charges.

SELECTED ADVANCED UNDERGRADUATE COURSES

PY 401, 402 Quantum Physics I, II. *Preq.: PY 411. 3(3-0) F,S.*

PY 407 Introduction to Modern Physics. *Preqs.: PY 208, MA 202. 3(3-0) F,S.*

PY 410 Introductory Nuclear Physics. *Preq.: PY 202 or 208. 4(3-2) F,S.*

PY 411, 412 Mechanics I, II. *Preqs.: PY 203 or 208, MA 301. 3(3-0) F,S.*

PY 413 Thermal Physics. *Preq.: PY 202 or 208; Coreq.: MA 301. 3(3-0) S.*

PY 414, 415 Electricity and Magnetism I, II. *Preqs.: PY 203 or 208, MA 301. 3(3-0) F,S.*

PY 441 Spacetime Physics. *Preq.: PY 203 or 407. 3(3-0) F.*

PY 451, 452 Intermediate Experiments in Physics I, II. *Coreqs.: PY 411, 414. 2(0-4) F,S.*

PY 499 Special Problems in Physics. *Preq.: Consent of department. 1-6 F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

PY 506 Nuclear Physics I. *Preqs.: PY 203 or 407; PY 412. 4(3-2) F.* Nuclear properties and phenomena such as alpha, beta and gamma decay, accelerator-induced nuclear reactions and fission. Emphasis on experimental techniques for probing nuclear structure and interpretation of results in terms of current theories. Tilley

PY 508 Ion and Electron Physics. *Preq.: PY 414. 3(2-2) F.* Topics include collision processes, electron emission, charged particle dynamics, gaseous discharges and the physics of ion and electron beams. Armstrong

PY 509 Plasma Physics. *Preq.: PY 414. 3(3-0) F.* The individual and collective motion of charged particles in electric and magnetic fields and through ionized gases. Armstrong

PY 510 Nuclear Physics II. *Preq.: PY 410. 4(3-2) S.* The properties of the atomic nucleus as revealed by radioactivity, nuclear reactions and scattering experiments with emphasis on the experimental approach. The laboratory stresses independent research and offers project work in nuclear spectroscopy and in neutron physics. Waltner

PY (NE) 511 Nuclear Physics for Engineers. *Preq.: PY 410. 3(3-0) F.* The properties of atomic nuclei, of nuclear radiations and of the interaction of nuclear radiation with matter. Emphasis on the principles of modern equipment and techniques of nuclear measurement and their application to practical problems. Waltner

PY 516 Physical Optics. *Preq.: PY 415. 3(2-2) F.* Emphasis on the wave properties of light. Subjects include boundary conditions, optics of thin films, interference and diffraction, applications to absorption, scattering and laser operation. A background in Maxwell's equations and vector analysis is required. Manring

PY 517 Atomic and Molecular Physics. *Preqs.: PY 401, 412. 3(3-0) S.* The quantum mechanical treatment of structure and spectra for atoms and molecules. Topics include the hydrogen atom, helium atom, multielectron atoms, selection rules, diatomic and simple polyatomic molecules and nuclear magnetic resonance spectroscopy. Mowat

PY 520 Measurements in Nuclear Physics. *Preq.: PY 410. 3(2-2) S.* Fundamentals of statistics (including the binomial, normal, Poisson and interval distributions) as applied to the analysis of measurements on nuclear reactions and radioactivity. Waltner

PY 521 Statistical Physics I. *Preqs.: PY 401, PY 413. 3(3-0) S.* The basic elements of kinetic theory and equilibrium statistical mechanics, both classical and quantum; applications of the techniques developed to various ideal models of noninteracting particles.

Lado

PY 543 Astrophysics. *Preqs.: PY 203 or 407; PY 411. 3(3-0) S.* The basic physics necessary to investigate, from observational data, the internal conditions and evolution of stars. Topics include the formation and structure of spectral lines, methods of energy generation and transport, stellar structure, degeneracy, white dwarfs and neutron stars.

Danby

PY (ECE) 552 Introduction to the Structure of Solids. *Preq.: PY 401. 3(3-0) S.* Basic considerations of crystalline solids, metals, conductors and semiconductors.

Schetzina

PY 553 Introduction to the Structure of Solids II. *Preq.: PY 552 or equivalent. 3(3-0) F.* A study of the properties of semiconductors, superconductors, magnets, ferroelectrics and crystalline defects and dislocations.

Haase

PY (MA) 555 Mathematical Introduction to Celestial Mechanics. *3(3-0) F.* (See mathematics.)

PY (MA) 556 Orbital Mechanics. *3(3-0) S.* (See mathematics.)

PY 560, 561 Experimental Physics I, II. *Preqs.: (560) Grad. standing; (561) Grad. standing, PY 560. 2(0-4) F,S.* Advanced investigations in experimental physics. Emphasis on techniques of use in many areas of physics and measurement of phenomena of current general interest. PY 560 emphasizes electronic measurement instrumentation and PY 561 emphasizes advanced experimental projects.

Johnson

PY 581, 582 Quantum Mechanics I, II. *Preqs.: MA 512; PY 411 or 414; grad. standing or permission of the graduate administrator. 3(3-0) F,S.* Fundamental concepts and formulations, including interpretation and techniques, and the application of theory to simple physical systems, such as the free particle, the harmonic oscillator, the particle in a potential well and central force problems. Other topics include approximation methods, identical particles and spin, transformation theory, symmetries and invariance, and an introduction to quantum theory of scattering and angular momentum.

Klenin

PY 583 Advanced Classical Mechanics I. *Preqs.: MA 512, PY 412, PY 414; grad. standing or permission of the graduate administrator. 3(3-0) F.* An introduction to theoretical physics in preparation for advanced study. Emphasis is on classical mechanics, special relativity and the motion of charged particles. Topics include variational principles, Hamiltonian dynamics and the canonical transformation theory, structure of the Lorentz group and elementary dynamics of unquantized fields.

Lado

PY 584 Advanced Classical Mechanics II. *Preqs.: PY 583; grad. standing or permission of the graduate administrator. 3(3-0) S.* Advanced classical mechanics, including continuum mechanics, fields, the group theoretical approach to dynamics and other selected topics.

Katzin

PY 585, 586 Advanced Electricity and Magnetism I, II. *Preqs.: PY 415; grad. standing or permission of the graduate administrator. 3(3-0) F,S.* Topics include: techniques for the solution of potential problems, development of Maxwell's equations; wave equations, energy, force and momentum relations of an electromagnetic field; covariant formulation of electrodynamics; radiation from accelerated charges.

Hall

PY 590 Special Topics in Physics. *Preq.: Consent of department. Credits arranged. F,S.* Investigations in physics under staff guidance. May consist of literature reviews, experimental or theoretical projects or special topics lectures.

Graduate Staff

FOR GRADUATES ONLY

PY 600 Planetary Atmospheres. *Preqs.: PY 517. 3(3-0) S.* Gas dynamics of atmospheres with emphasis on recent results of rocket, satellite and interplanetary probes. Theories of the aurora, aurora and ionosphere are developed. Manring

PY 601, 602 Theoretical Physics I, II. *Preqs.: PY 583, 586; Coreq.: MA 661. 3(3-0) F,S.* The mathematical and theoretical approach to the relationships between various branches of physics is treated. The restricted theory of relativity, electro-dynamics, classical field theory and the general theory of relativity and geometro-dynamics are considered. Davis

PY 610 Theoretical Nuclear Physics. *Preqs.: PY 506, PY 581. 3(3-0) Alt. S.* A study of theoretical methods and applications of quantum mechanics on various nuclear problems. Topics include nucleon-nucleon interaction, nuclear scattering theory, angular momentum theory (Racah algebra), polarization, theories of nuclear structure including the shell model, collective models and unified model nuclear reaction theories including compound nucleus, optical model, direct reactions, nuclear fission and nuclear fusion, energy production in stars and heavy-ion physics. Graduate Staff

PY 611 Advanced Quantum Mechanics I. *Preqs.: MA 512, PY 582. 3(3-0) F.* An introduction to the relativistic quantum theory of Dirac particles and the positron. Other topics include second quantization technique and its application to many-body problems, radiation theory and the quantization of the electromagnetic field. Cotanch

PY 612 Advanced Quantum Mechanics II. *Preqs.: PY 601, 611. 3(3-0) S.* A general propagator treatment of Dirac particles, photons, and scalar and vector mesons. Applications of Feynman graphs and rules will be given illustrating basic techniques employed in the treatment of electromagnetic, weak and strong interactions. Renormalization theory, the effects of radiative corrections and aspects of the general Lorentz covariant theory of quantized fields will also be considered. Cotanch

PY 622 Statistical Physics II. *Preqs.: PY 521. 3(3-0) F.* A continuation of PY 521, with emphasis on the static and dynamic properties of real (interacting) systems. Topics will include the equilibrium theory of fluids and the linear response theory of time-dependent phenomena. Lado

PY (ECE) 627 Semiconductor Thin Films Technology. *3(3-0) Alt. S.* (See electrical and computer engineering.)

PY 630, 631 Nuclear Structure Physics I, II. *Preqs.: PY 582; PY 506 or 510. 3(3-0) F,S.* Advanced description of nuclear models and nuclear reactions. Topics include: internucleon forces, compound-nucleus processes, shell model, optical model, R-matrix theory, direct reactions, collective model, electromagnetic transitions, isobaric analog states. Mitchell

PY 641 Non-Inertial Space Mechanics. *Preqs.: MA 661, PY 601; Coreq.: PY 602. 3(3-0) S.* This course treats the theoretical description of the phenomena of mechanics relating to non-inertial frames of reference, with applications to space travel and the instrumentation problems of rocketry. Applications to inertial guidance and electromagnetic-inertial coupling effects are also considered. Davis

PY 651 Mathematics of Solid-State and Many-Body Theory. *Preqs.: MA 513, PY 552, PY 582. 3(3-0) F.* Fourier techniques from solid-state theory are generalized and adapted to many areas of physics. Topics include: Fourier series in n-dimensional Bravais lattices, Fourier integrals, Schwartz distributions, Brillouin zones, Green's function, Patterson functions, convolutions and correlation coefficients. The Poisson sum formula and the theta function summation method are extensively developed for Bravais and non-Bravais lattices in n-dimensions. Hall

PY 652 Cooperative Phenomena in Solids. *Preq.: PY 651. 3(3-0) S.* Classical and quantum theories of equilibrium and transport properties of ferromagnetism, antiferromagnetism, and order-disorder in alloys. Statistical mechanics of, and phase transitions in, these and other systems are treated. Hall

PY 653 The Quantum Theory of Solids. *Preqs.: PY 521, PY 552, 582. 3(3-0) Alt. S.* A survey of advanced topics in the description of condensed matter. The course is intended to provide an introduction to current theoretical research tools. Klenin

The following five courses offer opportunities for advanced study in special areas of physics under staff members working in these areas.

PY 690 Special Topics in Molecular Physics. *Preq.: CI. 1-6 F,S.*

PY 691 Special Topics in Nuclear Physics. *Preq.: CI. 1-6 F,S.*

PY 692 Special Topics in Plasma Physics. *Preq.: CI. 1-6 F,S.*

PY 693 Special Topics in Solid State Physics. *Preq.: CI. 1-6 F,S.*

PY 694 Special Topics in Theoretical Physics. *Preq.: CI. 1-6 F,S.*

PY 695 Seminar. *1(1-0) F,S.* Reports on topics of current interest in physics. Several sections are offered so that students with common research interests may be grouped together. Graduate Staff

PY 699 Research. *Credits Arranged.* Graduate students sufficiently prepared may undertake research in some selected field of physics. Graduate Staff

Physiology

GRADUATE FACULTY

Professor J. P. Thaxton, Coordinator

Professors: R. A. Argenzio, J. H. Britt, L. Goode, C. H. Hill, E. Hodgson, B. H. Johnson, T. E. LeVere, I. S. Longmuir, W. D. Oxender, J. F. Roberts, M. C. Roberts, D. E. Smith, C. E. Stevens, C.-S. Teng; *Professor Emeritus:* L. C. Ulberg; *Associate Professors:* E. V. Caruolo, V. L. Christensen, F. W. Edens, M. S. Hand, H. A. Underwood Jr.; *Assistant Professors:* J. T. Blake, R. M. Grossfeld, P. A. Noden, N. C. Olson, T. D. Siopes

Graduate study under the direction of the physiology faculty may lead to the Master of Science, Master of Life Sciences and the Doctor of Philosophy degrees. The physiology faculty is an interdepartmental group drawn from the departments participating in the program. They are animal science, biochemistry, entomology, poultry science, psychology, (veterinary) anatomy, physiological sciences and radiology and zoology. The program emphasizes the comparative approach implicit in this type of organization.

Experimental facilities of the above departments are available for physiological research, as are such special facilities as the Electron Microscope Center and the

Wrightsville Marine Biomedical Laboratory. Experimental animals available cover a wide range, from insects and other invertebrates to large mammals.

In addition to courses in physiology, majors in the program are expected to take selected courses in biochemistry and cell biology. Minors are usually chosen from such fields as biochemistry, entomology, genetics, statistics, toxicology and zoology. A strong basic knowledge in one of these areas is essential.

Graduate students enrolled as physiology majors are located in the department of their major professor and may participate in departmental activities.

Prerequisites for admission include a year of physics and organic chemistry, one course in biochemistry and physiology. The Aptitude Test of the Graduate Record Examination is required and the Advanced Tests in biology and chemistry are desirable.

Financial assistance for qualified students in the form of research assistantships, fellowships and traineeships is available through participating departments. Prospective students may obtain further information by writing to any one of the graduate faculty listed above or to the Coordinator, Physiology Program, P. O. Box 5307, N. C. State University, Raleigh, North Carolina 27650.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

PHY (ANS) 502 Reproductive Physiology of Vertebrates. 3(3-0) S. (See animal science.)

PHY (ZO) 503 General Physiology I. *Preq.: Sr. or grad. standing. 3(3-0) F.* The general principles of homeostasis will be discussed, emphasizing the importance of integrative action. The following systems will be studied: muscular, cardiovascular and nervous systems.
Grossfeld

PHY (ZO) 504 General Physiology II. *Preq.: Sr. or grad. standing. 3(3-0) S.* The general principles of homeostasis will be discussed, emphasizing the importance of integrative action. The following will be studied: alimentary, renal, respiratory and endocrine systems.
Grossfeld

PHY (ZO) 513 Comparative Physiology. 4(3-3) S. (See zoology.)

PHY (MB, PO) 552 Immunobiology. 3(2-3) S. (See poultry science.)

PHY (BCH) 553 Physiological Biochemistry. 3(3-0) S. (See biochemistry.)

PHY (ZO, ENT) 575 Physiology of Invertebrates. *Preq.: ZO 202 or CI. 3(3-0) S.* The course deals with the physiology of the invertebrates, including the Insecta but excluding the Protozoa. The unity of the physiology of the various groups is stressed, and the relationship of physiology to contemporary biology and to other related biological fields will be illustrated.
Graduate Staff

PHY (ANS) 580 Mammalian Endocrine Physiology. 3(3-0) F. (See animal science.)

PHY 590 Special Problems in Physiology. *Preqs.: Grad. standing, CI. Credits Arranged. F, S.*
Graduate Staff

FOR GRADUATES ONLY

PHY (ANS) 604 Experimental Animal Physiology. 4(2-4) F. (See animal science.)

- PHY 690 **Physiology Seminar.** *Preq.: Grad. standing. 1(1-0) S.* Graduate Staff
- PHY 695 **Selected Topics in Physiology.** *Preq.: Grad. standing. 1-4.* Graduate Staff
- PHY 699 **Physiological Research.** *Preqs.: Grad. standing, CI. Credits Arranged. F.S.* Graduate Staff

COURSES FROM ASSOCIATED DEPARTMENTS

- BCH 551 **General Biochemistry I.**
- GN 633 **Physiological Genetics.**
- PO (ZO) 524 **Comparative Endocrinology.**
- PSY 502 **Physiological Psychology.**
- ZO 614 **Advanced Cell Biology.**

OTHER SUPPORTING COURSES AVAILABLE

- GN (ZO) 532 **Biological Effects of Radiations.**
- PSY 503 **Comparative Psychology.**
- ZO 510 **Animal Behavior Research Techniques.**

Certain courses on the interface between physiology and engineering may be taken after consultation with adviser and the instructors concerned.

Plant Pathology

GRADUATE FACULTY

Professor R. Aycock, Head

Professors: J. L. Apple, C. W. Averre III, K. R. Barker, D. F. Bateman, M. K. Beute, E. B. Cowling, C. B. Davey, H. E. Duncan, E. Echandi, G. V. Gooding Jr., L. F. Grand, S. F. Jenkins Jr., R. K. Jones, M. P. Levi, L. T. Lucas, C. E. Main, R. D. Milholland, N. T. Powell, J. N. Sasser, P. B. Shoemaker, D. L. Strider, H. H. Triantaphyllou, N. N. Winstead; *Professors (USDA):* K. J. Leonard, R. A. Reinert, J. P. Ross, H. W. Spurr Jr.; *Adjunct Professor:* G. H. Hepting; *Professors Emeriti:* C. N. Clayton, D. E. Ellis, T. T. Hebert, G. B. Lucas, L. W. Nielsen, C. J. Nusbaum, F. L. Wellman; *Extension Professor Emeritus:* J. C. Wells; *Associate Professors:* D. M. Benson, B. C. Haning, J. S. Huang, J. W. Moyer, D. P. Schmitt, T. B. Sutton, C. G. Van Dyke; *Associate Professor (USDA):* A. S. Heagle; *Adjunct Associate Professor:* N. A. Lapp; *Assistant Professors:* J. E. Bailey, R. I. Bruck, C. L. Campbell, M. E. Daub, W. G. Daugherty, W. M. Hagler Jr., G. A. Payne, D. F. Ritchie, H. D. Shew

The plant pathology faculty exhibits strength in forest pathology, mycology, nematology, virology and general plant pathology. Programs leading to the Master of Agriculture and Master of Life Sciences (non-thesis), Master of Science and Doctor of Philosophy degrees are offered. Program requirements for these three degrees generally follow University policies: 30 credit hours and thesis for the M.S. degree; 36 for the Master of Agriculture and Master of Life Sciences degrees. The latter afford students an opportunity for general training with a major emphasis in plant pathology course work and subject matter.

Courses and number of hours taken by Ph.D. candidates are determined by the student's interest and background. Strong foundation courses in mathematics, biochemistry, chemistry, physics and soil science are prerequisite, however, for admission to candidacy for the Ph.D. degree. Students who enroll in any graduate program should have achieved a "B" average in the undergraduate major.

Opportunities for employment include research, extension and teaching appointments at Land-Grant colleges or universities and with the U. S. Department of Agriculture. The agricultural chemicals industry also employs plant pathologists in research, promotion and service. Plant pathologists often participate in foreign service through international and federal organizations, as well as in commercial enterprises.

Separate laboratories fully equipped and staffed for research in nematology, virology, soil microbiology, physiology of pathogenesis and special biochemical problems are available. Facilities also exist for training in general phytopathology. Since the faculty is comprised of more than 50 scientists with varied interests, in-depth training in all of these areas is possible.

The department has greenhouse facilities and access to controlled environmental growth chambers in the phytotron. Student participation in the Plant Disease Clinic provides experience in the diagnosis of all types of plant diseases.

North Carolina exhibits a wide range of soil types and climatic areas. Large acreages are planted to a variety of field, vegetable and ornamental crops, as well as forest trees. Special facilities for experimental work on diseases of these crops are found at 16 permanent research stations located throughout the state.

A number of graduate assistantships and fellowships are funded by the Agricultural Research Service, the Agricultural Foundation and other agencies. Stipends are adjusted to the previous training and experience of the recipients. Special supplements to stipends are available on a competitive basis for outstanding students from university funds and from bequests made to the department through the Agricultural Foundation. Students applying directly for aid from the National Science Foundation, the National Institutes of Health and other granting agencies are invited to specify the department as host institution.

SELECTED ADVANCED UNDERGRADUATE COURSES

PP 415 Plant Disease Control. *Req.: PP 315. 3(2-3) S.*

PP 450 Nematode Diseases of Plants and Their Control. *Req.: PP 315 or 318. 2(1-3) F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

PP 501 Phytopathology I. *Preq.: PP 315 or equivalent. 4(2-6) F.* Basic concepts of plant diseases caused by fungi and bacteria and their control will be studied. The history, classification, terminology, etiology, effect of environment on disease and variability in pathogens will be considered. Laboratory sessions will illustrate the topics mentioned above as they relate to diseases caused by fungi and bacteria. Echandi

PP 502A, B, C Phytopathology II. *Preq.: PP 315 or equivalent. 6(3-6) S.* Lectures and laboratory techniques in plant pathology presented as a series of five-week minicourses: PP 502A, nematode diseases; PP 502B, virus diseases; PP 502C, epidemiology. Students may enroll for one or all of the series. Each minicourse consists of lectures on principles and laboratories involving experimental techniques fundamental to the study of nematodes and viruses as plant pathogens and analyses of plant disease epidemics. Barker

PP 503 Plant Disease Diagnoses. *Preqs.: PP 501 and 502A,B,C or equivalent. 4(2-6) Alt. Sum.* Diagnoses of plant diseases in the field and laboratory, and operational aspects of a plant disease clinic will be stressed. Frequent field trips to experiment stations and private farms will provide opportunities for field observation of plant disease, plant disease research and diagnosis. Laboratory studies will emphasize identification and major sources of descriptive information of plant pathogens and abiotic agents. Milholland, Grand

PP 505 Histopathology. *Preq.: PP 501 or equivalent. 2(1-3) F.* Anatomical changes that occur in diseased plant tissues will be studied. The appropriate procedures of microtechnique necessary for interpretation of pathological changes in plant tissues will be considered. Laboratory assignments will involve projects on specific diseases including photography and scientific writing. Milholland

PP 515 Epidemiology and Plant Disease Control. *Preq.: PP 315 or PP 318. 3(3-0) S.* Consideration of fundamental concepts and principles of epidemiology as they apply to modern strategies of plant disease control. Special consideration is given to evaluation of current techniques for control of fungal, bacterial, viral and nematode pathogens in an integrated crop protection system. A term paper will be required to integrate concepts and principles of disease management for a specific crop. Beute

PP (FOR) 518 Advanced Forest Pathology. *Preq.: PP 318 or equivalent. 3(3-0) Alt. F.* An in-depth study of the epidemiology and control of forest tree diseases. The nature of pathogenesis and host genetics will be related to concepts of functional diversity and disease resistance in natural ecosystems. Environmental and quantitative epidemiology, silvicultural, biological and chemical amelioration of forest tree disease will be considered. Bruck

PP (BO, CS, ENT, PM) 525 Biological Control. *4(3-3) Alt. F.* (See pest management.)

PP (MB, BO) 575 The Fungi. *3(3-0) F.* (See botany.)

PP (MB, BO) 576 The Fungi—Lab. *1(0-3) F.* (See botany.)

PP 595 Special Problems in Plant Pathology. *Preq.: CI. Credits Arranged. Maximum 6.* Investigation of special problems in plant pathology not related to a thesis problem. The investigations may consist of original research and/or literature survey. Graduate Staff

FOR GRADUATES ONLY

PP 604 Morphology and Taxonomy of Nematodes. *Preqs.: PP 450, CI. 3(1-6) S.* A study of the morphology, anatomy and taxonomy of nematodes with emphasis on the identification of

important plant-parasitic genera. Exercises include preparation of semipermanent and permanent nematode mounts. (Offered 1984 and alt. years.) Triantaphyllou

PP 605 Molecular Biology of Plant Viruses. *Preqs.: PP 502B, BCH 451 or 551. 4(2-6) Alt. S.* An in-depth study of plant viruses with emphasis on the relationship between viral structure and function. Areas covered include infection, replication, genomic expression, encapsidation and transmission. Laboratory introduces students to contemporary molecular techniques. Dougherty

PP 608 History of Phytopathology. *Preqs.: PP 315, CI. 1(1-0) F.* Development of the science of phytopathology from its early beginnings to the early part of the 20th century. (Offered 1985 and alt. years.) Campbell

PP 611 Advanced Plant Nematology. *Preqs.: PP 604 and CI. 3(2-3) F.* A study of the biology, genetics, physiology and ecology of nematodes, especially plant-parasitic forms. Primary topics include embryogenesis, post-embryonic development, gametogenesis, cytology, reproduction, sexuality, evolution, behavior, host-parasite relationships, metabolism, mechanisms of pathogenesis, interactions with other pathogens, distribution and population dynamics and impacts on crop performance. Laboratory exercises include small research projects in each area of study and demonstrations of techniques and materials. (Offered in 1984 and alt. years.) Barker, Triantaphyllou

PP 612 Plant Pathogenesis. *Preqs.: PP 500, CI. 3(2-3) F.* Infection processes, alterations in photosynthesis, respiration, nitrogen metabolism, vascular function and growth regulator function are considered. The biochemical nature of the weapons utilized by pathogens in pathogenic attack and the defensive mechanisms employed by the hosts in resisting attack and the resultant dynamic interactions are studied. (Offered in 1985 and alt. years.) Huang

PP 614 Nematode Development, Cytology and Genetics. *Preq.: PP 604 or CI. 2(1-3) F.* A study of embryogenesis, post-embryonic development, gametogenesis, cytology, reproduction, sexuality, genetics and evolution of nematodes with emphasis on plant-parasitic forms. Laboratory exercises include small research projects in each area of study and demonstrations of techniques and materials. (Offered 1984 and alt. years.) Triantaphyllou

PP 615 Botanical Epidemiology. *Preqs.: PP 501, 502 or CI; Coreq.: ST 511. 4(2-6) S.* Advanced study of the dynamics of plant disease epidemics in relation to agricultural crop production and forestry systems. Emphasis will be placed upon epidemiological concepts and principles, pathogen and host dynamics, disease forecasting, geographic distribution of pathogens, crop-loss assessment and the development of theoretical and practical disease-management strategies. (Offered 1985 and alt. years.) Bruck, Campbell, Main

PP (BO) 625 Advanced Mycology. *Preq.: PP 575 or CI. 4(2-6) F.* An in-depth treatment of major groups of fungi. Aspects of taxonomy, nomenclature, developmental morphology, genetics, host-parasite relations, physiology and ecology will be presented. Cardinal characteristics of selected fungi representing the major groups are determined. Field observations and collecting are also required. (Offered 1984 and alt. years.) Grand

PP 650 Colloquium in Plant Pathology. *Preq.: PP 502 or CI. 3(3-0) S.* Group discussion of topics assigned by the instructor in order to develop a thorough understanding of basic concepts and their significance in the etiology, pathogenesis, epidemiology and control of plant diseases. The genesis and evolution of fundamental ideas and values and how new techniques and the acquisition of new knowledge influence the advancement of plant pathology and its various specialized fields are considered. (Offered 1984 and alt. years.) Graduate Staff

PP 690 Seminar in Plant Pathology. *Preq.: Consent of seminar chairman. 1(1-0) F,S.* Discussion of assigned phytopathological topics. Moyer

PP 699 Research in Plant Pathology. *Preqs.: Grad. standing, CI. Credits Arranged.*
Original research in plant pathology. Graduate Staff

Political Science and Public Administration

GRADUATE FACULTY

Professor J. O. Williams, Head

Professors: W. J. Block, G. D. Garson, A. Holtzman, R. O. Tilman; *Professors Emeriti:* F. V. Cahill Jr., J. T. Caldwell; *Associate Professors:* T. D. Edgmon, E. S. Fairchild—*Graduate Administrator,* J. H. Gilbert, H. G. Keschull, J. P. Mastro, J. M. McClain, E. O'Sullivan, K. S. Petersen, E. R. Rubin, M. S. Soroos, D. W. Stewart, J. E. Swiss, M. L. Vasu; *Assistant Professors:* B. A. Cigler, R. H. Dorff, S. H. Kessler, J. B. Rosch

The Department of Political Science and Public Administration offers programs leading to the Master of Public Affairs degree and the Master of Arts degree.

A candidate for admission to either program must have demonstrated an aptitude for graduate study as indicated by the Graduate Record Examination; the student may also be required to take certain undergraduate courses to make up any deficiencies that may exist in the undergraduate record.

The Master of Public Affairs degree requires completion of a 39-semester hour professional program for persons who are now or hope to be employed by government or by a government-related private enterprise or association. An internship in a government agency, or a field paper for persons with previous public sector experience, is required.

The program requires 30 hours to be selected from courses offered by the Department of Political Science and Public Administration, including 15 hours of core courses. Students may concentrate in public management, human resource management, policy research and evaluation, urban management, environmental management or administration of justice. The remaining hours may be taken in another discipline, such as economics and business, education, operations research, psychology, recreation, sociology and statistics or as an interdisciplinary sequence of courses.

Students who enroll in the program should have completed twelve hours in the social sciences as undergraduates and have achieved a B average in the last two years of school. PA 571, a core course, has a statistics prerequisite.

The Master of Arts degree requires each candidate to complete 30 hours of graduate work including three hours in Research Methods and Analysis (PA 571). The candidate must concentrate (18-21 hours, including thesis) in two major fields of political science. Major fields are to be selected from the following: political theory, American politics, comparative politics, international relations and public administration. A disciplinary minor of 9 to 12 hours outside the Department of Political Science and Public Administration is required. A student's work in a

minor field must constitute a unified pattern and must contribute to one or both of the student's major fields.

In either program the student selects a graduate committee chairperson for the preparation of a program of study which shall be subject to the approval of two other committee members, including one from outside the Department of Political Science and Public Administration.

Comprehensive written and oral examinations are required of every candidate for both degrees. In addition, a candidate for the Master of Arts degree must demonstrate reading proficiency in one modern language (normally German, French, Spanish or Russian) or a research skill and must write a thesis in one of his or her major areas.

SELECTED ADVANCED UNDERGRADUATE COURSES

PS 401 American Parties and Interest Groups. 3(3-0) *F*.

PS 402 Campaigns and Elections in the American Political System. *Preq.: PS 201.* 3(3-0) *F,S*.

PS 406 Politics and Policies of American State Governments. 3(3-0) *F,S,Sum*.

PS 408 Urban Politics. 3(3-0) *F,S*.

PS 411 Public Opinion and the Media. *Preq.: Six hours of social science.* 3(3-0) *S*.

PS 431 International Law and Organization. 3(3-0) *F*.

PS 437 National Security Policy. *Preq.: PS 331.* 3(3-0) *S,Sum*.

PS 446 Comparative Communist Systems. *Preq.: PS 344 or 332.* 3(3-0) *F,S*.

PS 447 Political Development. *Preq.: Six hours of PS.* 3(3-0) *F*. *Alt. yrs.*

PS 448 Politics of European Integration. *Preq.: Six hours of comparative politics.* 3(3-0) *S*.

PS 498 Special Topics in Political Science. *Preq.: Six hours of PS.* 3-6 *F,S*.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

PA 505 Administrative Law. *Preq.: Grad. standing or PBS status.* 3(3-0) *S*. Case law of the exercise of administrative power, judicial and legislative control of administrative action, legal rights of public employers and legal procedures of administrative tribunals.

McClain

PA 508 Urban Politics. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status.* 3(3-0) *S*. A comparative study of political conditions in cities and localities. Topics will include the formal structures and rules of city and metropolitan governments, and the relationships to the informal norms and distribution of power; patterns of local decision making; elite recruitment and citizen participation; variations of local autonomy and the scope of local politics; approaches to urban policy issues.

Cigler

PA 509 Problems in Urban and Metropolitan Area Government. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) S.* This course examines theory and research on problems affecting governments in metropolitan areas. Principal attention is given to those problems which affect (or result from) governmental structure, institutions and politics and to the alternative approaches to their solution. Cigler

PA 511 Public Administration. *Preq.: Advanced undergrad. standing including 12 hours in political science, grad. standing or PBS status. 3(3-0) F,S,Sum.* A general survey of the field of public administration, examining formal and informal organizations, processes of administration, the political environment of administration and administrative responsibility and accountability. Block, McClain

PA 513 Financial Management in the Public Sector. *Preqs.: ACC 265 and grad. standing or PBS status. 3(3-0) F.* This course surveys financial practices and concepts in the public sector. Topics covered include: public sector accounting, financial information systems, revenue projections, cash management and debt management. Case-based applications are emphasized. Coe

PA 515 Administration of Criminal Justice. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. Credit for both PS 415 and PA 515 is not allowed. 3(3-0) F.* A study of politics and administration in the American criminal justice system. The interrelationships between ideology, organization and policy outputs are emphasized in the analysis of major problems confronting the system today. Topics included are: intergovernmental relations, discretionary justice, impact of judicial decisions on criminal justice administration and management trends in criminal justice bureaucracies. Fairchild, Rosch

PA 516 Public Policy Analysis. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) F,S,Sum.* Course covers methods and techniques of analyzing, developing and evaluating public policies and programs. Emphasis is given to benefit-cost and cost-effectiveness analysis and concepts of economic efficiency, equity and distribution. Methods include problem solving, decision making and case studies. Examples are used in human resource, environmental and regulatory policy. Swiss, Williams

PA 518 Organization Design. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) S.* An examination of contemporary approaches to organization design, including organization development, sociotechnical systems analysis and various forms of organizational participation ranging from human relations to self-management models. Issues in personnel administration are emphasized in relation to public management and government structure. Graduate Staff

PA 519 Corrections Management. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) S.* An introduction to the theory and practice of correctional program management in the United States. Historical trends as well as contemporary issues in corrections management will be considered. Topics to be included are: leadership problems, probation and parole management, personnel, budget and program evaluation. Fairchild

PA 520 Environmental Policy. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) F.* This course focuses on the formation and impact of environmental policy in the United States. Decision-making processes at all levels of government are examined. Comparisons are made between political, economic, social and technological policy alternatives. Emphasis is given to the application of policy analysis in environmental assessment, and theoretical perspectives on the nature of the environmental crisis are considered. Cigler, Edgmon

PA (FOR) 522 Natural Resources Policy and Administration. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) S.* Overview of the problems, issues and organization of natural resources policy and administration in the United States. Emphasis on the theoretical basis for the organization of resources and environmental policies, the political and institutional basis of natural resources policy and administration and the examination of the formulation and implementation of resources policies in selected issue areas. Edgmon

PA 533 Global Problems and Policy. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. Credit for both PS 433 and PA 533 is not allowed. 3(3-0) F.* International policy processes and policy responses to problems of global scope including the role of international law. Consideration given to economic development, human rights and other policy problems selected for specific semesters. Independent research on a global policy problem of student's choice. Soroos

PA 564 Ethics and Public Policy. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) F.* The ethical dimensions of contemporary public policy issues. Consideration of selected topics such as the proper relationship between equality and social policy, the ethics of alternative economic systems and legal attempts to promote personal morality. Kessler

PA 571 Research Methods and Analysis. *Preqs.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status and an introductory course in statistics. 3(3-0) F.* S.A focus on the behavioral approach to the study of political and administrative behavior. Topics include the philosophy of social science; experimental, quasi and non-experimental research design; data collection techniques; basic statistical analysis with computer applications. O'Sullivan, Vasu

PA 572 Applied Research Analysis. *Preqs.: Grad. standing or PBS status and PA 571 and ST 507 or equivalent. 3(3-0) F.* An introduction to the use of advanced statistical and research tools for analysis in public administration, political science and public policy. An overview of the application of multivariate statistics and advanced research design considerations to the analysis of political data. O'Sullivan

PA 573 Computer Applications in Public Affairs. *Preqs.: ST 507; CSC 462 or PS 371 or PA 571. 3(1-6) S.* Sum. The methodology, data analysis techniques and computer-based skills necessary to conduct and manage applied research. The course focuses on the analysis and processing of data through the medium of conventional computer software frequently used in the field, i.e., SPSS, SAS. Edgmon

PA 574 Data Management in Public Administration. *Preqs.: PS 374 or PA 573 and previous coursework or experience in public administration. 3(3-0) S.* An introduction to managerial applications of data management in public budgeting, public personnel and public policy analysis. Microcomputers are used to construct data bases and analytic models in these areas. Garson

PA 581 Equal Employment Opportunity and Affirmative Action. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 1(1-0) Sum.* A seminar examining political, legal, attitudinal and technical factors influencing programs of Equal Employment Opportunity and Affirmative Action, including program development and implementation. Stewart

PA 582 Managerial Leadership. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 1(1-0) Sum.* The course examines alternative behavioral and contingency theories of managerial leadership as applied to governmental settings and their relation to motivation research and incentive system design in the public sector. Garson

PA 583 Performance Appraisal in Government. *Preq.: Advanced undergrad. standing including 12 hours in political science, grad. standing or PBS status. 1(1-0) Alt. Sum.* The course examines alternative designs for performance appraisal, performance evaluation and work measurement in the public sector. Garson

PA 590 Readings and Research. *Preq.: Grad. standing. 1-3 F,S,Sum.* To enable graduate students to pursue a subject of particular interest to them by doing extensive readings or research in that subject under direct, individual faculty supervision. Graduate Staff

PA 598 Special Topics in Public Administration. *Preq.: Advanced undergrad. standing including 12 hours in political science, grad. standing or PBS status. 1-6 F,S,Sum.* Detailed investigation of contemporary topics in the fields of public administration. Topic and mode of study determined by program faculty. Graduate Staff

PS 502 The Legislative Process. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) S.* A study of the formulation of public policy from the institutional and behavioral viewpoints. Important current legislative problems at the congressional and state legislative levels will be selected and will serve as a basis for analyzing the legislative process. Holtzman

PS 506 American Constitutional Theory. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) F.* Basic constitutional doctrines, including fundamental law, judicial review, individual rights and political privileges and national and state power. Special attention is given to the application of these doctrines to the regulation of business, agriculture and labor and to the rights safeguarded by the First, Fifth and Fourteenth Amendments to the Constitution. Rubin

PS 507 Constitutional Theory II. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) F,S.* A continuation of PS 506, but may be elected separately. An examination of leading constitutional cases, especially in the fields of civil liberties and individual rights and the writings of leading commentators. Rubin

PS 512 Comparative Administration. *Preq.: PA 511 or PS 346 or CI. 3(3-0) F,S.* Concentration will be on administrative systems of developing nations with limited attention to developed systems. The major emphasis will be on administrative aspects of governmental change and modernization in developing nations; colonial influence on administration; problems of establishing new nations and adapting to change in established states; bureaucratic development and behavior; theories of development administration. Graduate Staff

PS 514 Public Finance. *Preq.: EB 205. 3(3-0) F.* A survey of the theories and practices of governmental taxing, spending and borrowing, including intergovernmental relationships and administrative practices and problems. Coe

PS (SOC) 517 The Police Bureaucracy in a Democratic Society. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) S.* This is a political science seminar which focuses on the proposition that police departments are bureaucratic organizations which can be studied as such. Emphasis is placed on understanding the process by which police policy is made. Internal and external, psychological and structural variables are identified in tracing decisions on specific issues. Thus, attitudes of policemen, the nature of their work and the resources and power of various constituencies are factors seen as determining police behavior. Fairchild, Rosch

PS 561 Ancient Political Theory. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) F.* A study of selected classics in the tradition of ancient political theory. Authors to be read include Plato, Aristotle, Aristophanes, Xenophon and Cicero. Kessler

PS 562 Modern Political Theory. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. 3(3-0) S.* A study of selected classics in the tradition of modern political theory. Authors to be read include Machiavelli, Hobbes, Locke, Montesquieu, Rousseau, Marx and Nietzsche. Kessler

PS 563 Power and Ideology. *Preq.: Advanced undergrad. or grad. standing. 3(3-0) F.* This course will explore competing theories of power and its distribution in the United States and of the nature of ideology. It will analyze various forms of elite theory, particularly pluralist theory and its critics and of empirical democratic theory, with specific reference to the concepts of power and ideology. Primary attention will be given to the case of the United States, with projections made regarding the nature of power and ideology and the prospects for democracy in post-industrial societies. Graduate Staff

PS 569 Topics in Political Theory. *Preq.: Advanced undergrad. standing including 12 hours of political science, grad. standing or PBS status. (Maximum of 6 hours may be taken). 3(3-0) F.S.* A close examination of particular topics or theories that are not included in the basic courses in political theory. Course content changes in different years, and, with permission of instructor, the course may be repeated for credit. Examples of course topics are: "Foundations of Modern Radicalism," "Twentieth Century Political Philosophy and Political Science," "Political Philosophy and the Problem of Law" and "Origins of Political Science." Kessler

PS 590 Readings and Research. *Preq.: Grad. standing or PBS status. 1-3 F.S.Sum.* Graduate students pursue a subject of particular interest to them by doing extensive readings or research in that subject under direct, individual faculty supervision. Graduate Staff

PS 598 Special Topics in Political Science. *Preq.: 6 hours of political science. 1-6 F.S.* Detailed investigation of a topic. Topic and mode of study determined by the student and a faculty member. Graduate Staff

FOR GRADUATES ONLY

PA 608 Seminar in Urban Management. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) F.* A seminar focusing on the analytical techniques and managerial principles required for policy formation and implementation in a complex urban governmental environment. Specific topics include: urban planning and community development, housing, intergovernmental relations, organizational roles and decision making, budgeting and selected urban services (for example: police, transportation). Cigler

PA 611 Seminar in Public Personnel Management. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) F.S.* Examines the major issues in public sector personnel management. Among topics considered are: staffing, position classification, compensation, affirmative action, performance review and appraisal, patronage, training, career development, employee assistance, unionization and rights of public employees. Stewart

PA 612 The Budgetary Process. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) F.S.Sum.* This course examines generalized budgetary process used at all levels of government in the United States. Understanding of the process is based upon comprehension of the institutions in-

involved, the roles of politicians and professionals and the objectives of budgetary systems. The course also focuses upon budgetary reforms and on Planning-Programming-Budgetary and Zero-Based Budgeting as management tools.
Coe, McClain

PA 613 Government and Planning. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) F,Sum.* A study of the planning function at all levels of government in the United States, with particular attention to the problems posed for planning by the rapid growth of metropolitan areas. An overview of community development, urban spatial structure, housing economics and land use planning.
Vasu

PA 614 Seminar in Management Systems. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) S,Sum.* An examination, through case studies and applied methodology, of various management systems and management techniques. Among the topics considered are: differences between market and nonmarket organizations, financial management systems, quantitative decision-making approaches, planning techniques such as CPM and PERT, MBO and productivity systems.
Swiss

PA 615 Seminar in Administrative Problems. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hour of 500-level course work. 2-4. S,Sum.* An advanced course in administrative principles and methods. Students will perform individual or group research under supervision in specific administrative topics within the context of those public agencies which function in their respective fields of technology.
Block, McClain

PA 616 Seminar in Program Evaluation. *Preqs.: Grad. standing or Management Development Certificate Program and a grad. course in research methods. 3(3-0) F,S.* The course combines seminar and field research techniques to study the evaluation of public programs. Focus on political and administrative problems associated with program evaluation. The availability and appropriateness of various quantitative methodologies are also examined. Seminar concepts are applied through evaluative projects conducted for public agencies.
O'Sullivan

PA 617 Seminar in Organization Theory. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) F,S.* The seminar examines major conceptual frameworks developed to understand organizational behavior. Topics stressed include motivation, leadership, group dynamics, communication, socio-technical systems, work design and organizational learning. The emphasis is on applying theories and concepts to public sector organizations.
Stewart

PA 618 Seminar in Policy and Administration. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) F.* A seminar in theories and techniques of administration in applied situations, using case study techniques.
Block

PA 619 Intergovernmental Relations in the United States. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) S.* The course examines distinctive features of intergovernmental relations in the United States. Topics stressed include historical adaptations of federalism, the emerging role of the administrator, contemporary trends in intergovernmental relations and assessment of contemporary trends from federal, state and local perspectives.
Fairchild

PA (FOR) 620 Environmental Administration. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) S.* A review and investigation of the major environmental management systems utilized to plan, develop and implement environmental programs.
Edgmon

PA 621 Collective Negotiations in the Public Service. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) Sum.* This course includes intensive consideration of the background of the collective negotiations movement; analysis of key policy issues, such as bargaining rights and the use of strike weapons; framework for collective negotiations; scope and conduct of negotiations; impasse resolution; grievance procedure. Stewart

PA 691 Internship in Public Affairs. *Preq.: Minimum 9 hrs. graduate work. 1-6 F,S,Sum.* This course exposes the student to the environment and value systems of the public organization through a supervised work experience. It involves the application of substantive knowledge and analytical skills to organizational problems. Credit will vary with the nature of the work experience. O'Sullivan

PS 601 Seminar in Party and Group Politics. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) S.* This course examines in depth such problems as mobilization of consent, recruitment of leaders, financing and conduct of campaigns, nomination processes, interparty and intraparty politics, party-interest group relations and ideology and party-interest group relations with government and public policy. Short research papers will be required, some of which will be presented and evaluated in class. Holtzman

PS 602 Seminar in Legislative Problems. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) S.* This seminar considers basic problems characteristic of American legislative systems: development and maintenance for formal and informal rules of the game; relationships between outside inputs (by parties, interest groups, constituents, executives, courts) and legislators; strategies and tactics of leadership; committee decision making, roles and role behavior of legislators; bicameral and apportionment problems. Each student is required to do extensive reading, to interview legislators and those who seek to influence them and to prepare reports. Holtzman

PS 604 The Chief Executive. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0) S,Sum.* This course will focus upon three major concepts of the office of the chief executive as developed under several incumbents. First are the institutions which surround that office and which facilitate the expansion of its power and operations. Next are the various roles which are played by different chief executives. Last are the processes of leadership by which the chief executive can attempt to direct the machinery of government to achieve predetermined objectives. Holtzman

PS (ED) 607 The Politics of Higher Education. *Preqs.: Grad. standing or Management Development Certificate Program and six semester hours of 500-level course work. 3(3-0).* An examination of the differing and changing perceptions of the role of higher education in American society; the politics of competition for priority of attention and resources; organizational alternatives in its control; relevant elements in the structure and processes of government. References to other societies. Caldwell

PS 641 Seminar in Comparative Politics. *Preqs.: One course in comparative politics and one course in political science methodology or CI. 3(3-0) F,S.* This seminar will open with a survey of the problems and methods of comparative political analysis, after which students will be assigned a specific, limited subject to be examined within the framework of a systematic, analytical scheme appropriate to the topic. Specific topics will be drawn from the subjects of political ideologies, political groups, political elites and decision-making institutions and processes. Kebschull

PS 691 Internship in Political Science. *Preq.: Grad. standing. 1-6 F,S,Sum.* This course exposes the student to the environmental and value systems of public organizations through a supervised work experience. Graduate Staff

PS 696 Seminar in Politics. *Preq.: Advanced grad. standing. 2-4 F,S.* An independent advanced research course in selected problems of government and politics. The problems will be chosen in accordance with the needs and desires of the students registered for the course. Graduate Staff

PS 699 Research in Politics. *Preqs.: Grad. standing and approval of adviser. Credits Arranged. F,S.* Research for writing the master's thesis. Graduate Staff

Poultry Science

GRADUATE FACULTY

Professor R. E. Cook, Head

Professors: T. A. Carter, W. E. Donaldson, E. W. Glazener, P. B. Hamilton, C. H. Hill, C. R. Parkhurst, J. P. Thaxton, J. B. Ward; *Extension Professor:* J. R. Harris; *Associate Professors:* V. L. Christensen, F. W. Edens, J. D. Garlich, J. C. H. Shih; *Adjunct Associate Professors:* N. Chernoff, D. I. McRee; *Assistant Professors:* J. T. Brake, W. M. Hagler Jr., J. F. Ort, T. D. Siopes; *Adjunct Assistant Professor:* M. J. Galvin Jr.

ASSOCIATE MEMBERS OF THE DEPARTMENT

Professor: D. G. Simmons; *Associate Professor:* H. R. Ball Jr.; *Assistant Professor:* B. W. Sheldon

The Department of Poultry Science offers the Master of Science degree. Doctoral programs are offered in the disciplines of microbiology, physiology, genetics and nutrition.

The department occupies Scott Hall, containing well-equipped laboratories, animal rooms and offices. Additional research facilities are located on the University farms and the Piedmont Research Station.

The Dearstyne Avian Research Center, a three-building complex, is used in connection with special research projects related to disease resistance and treatment of various pathological conditions. The complex is made up of animal isolation rooms, biochemical laboratories and related facilities.

The research program is comprehensive and includes fundamental studies in genetics, microbiology, nutrition, pathology and physiology. In addition, investigation of problems of more practical urgency is undertaken when appropriate.

The demand for men and women with advanced training in poultry science is far greater than the supply. Opportunities exist for graduates in research and teaching in universities, in government and in private industry.

SELECTED ADVANCED UNDERGRADUATE COURSES

PO (FS) 404 Poultry Products. *Preq.: CH 220 or 221. 3(2-3) F.*

PO 405 Avian Physiology. *Preq.: CH 220. 4(3-3) F.*

PO 410 Production and Management of Game Birds in Confinement. *Preq.: PO 201. 3(2-3) S.*

PO (ANS, NTR) 415 Comparative Nutrition. *Preqs.: CH 220 or 221 and 223. 3(3-0) F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

PO (GN) 520 Poultry Breeding. *Preq.: GN 411. 3(2-2) S.* Application of genetic principles to poultry breeding, considering physical traits and physiological characteristics.

Graduate Staff

PO (ZO) 524 Comparative Endocrinology. *Preq.: ZO 421 or equivalent. 4(3-3) S.* Study of the endocrine system with respect to its physiological importance to metabolism, growth and reproduction.

Siopes

PO (MB, PHY) 552 Immunobiology. *Preq.: MB 551. 3(2-3) S.* A basic study of the ontogeny of immunobiological tissues and their subsequent roles in immunity. Primary emphasis will be on cell-mediated (T-cell) immunity and immunogenetics. Specific topics include blood groups, histocompatibility antigens, organ transplantation, immunosuppression and tolerance. Some inter-relationships of other physiological systems with the immune system will be discussed.

Thaxton

FOR GRADUATES ONLY

PO (ANS, NTR) 605 Mineral Metabolism. *3(3-0) F.* (See animal science.)

PO 698 Special Problems in Poultry Science. *Preq.: Grad. standing. Maximum 6 F,S.* Specific problems of study are assigned in various phases of poultry science.

Graduate Staff

PO 699 Poultry Research. *Preq.: Grad. standing. Credits Arranged. A maximum of six credits is allowed towards a master's degree. F,S.* Appraisal of present research; critical study of some particular problem involving original investigation. Problems in poultry breeding, disease, endocrinology, hematology, microbiology, nutrition or physiology.

Graduate Staff

Product Design

GRADUATE FACULTY

Professor V. M. Foote, Program Director

Professors: G. L. Bireline Jr., A. Lowrey, C. E. McKinney; Associate Professors: A. V. Cooke, R. A. Donaldson, G. N. Prygrocki, J. M. Wittkamp; Assistant Professors: C. E. Joyner, M. S. Lange, P. L. Middleton, S. D. Wilchins

Product design or industrial design is the professional service of creating and developing concept and visualizations that optimize the function, value and appearance of products, systems and communications for the mutual benefit of both user, manufacturer and the environment. The product design program offers programs of study in product design leading to the Master of Product Design. The

student's program of selected course work and terminal project are under the direction of his or her graduate advisory committee. The terminal project shall constitute the final test of the candidate's mastery of his or her design studies. The project shall be developed in the design studio or special projects framework in the final year and shall consist of an in-depth investigation of an approved problem which relates product design studies to the student's minor field. All students with a five-year undergraduate degree or equivalent or professional experience shall be required to complete a minimum of 30 hours of course work of which approximately 70 percent will be in the major field and the remainder elected from various specialized areas.

Applicants for this program may come from the following sources: graduates of approved schools of product design, graduates of approved programs of industrial design, graduates of approved schools of visual design, graduates of accredited schools of architecture or landscape architecture, graduates of approved schools of art and design, graduates of accredited schools of engineering and, under special circumstances, students with degrees in fields other than design. In those latter instances an advisory committee will evaluate the applicant's preparation with regard to design capabilities and professional competence. In addition, course offerings are available to any graduate student who can demonstrate reasonable competence or equivalent qualifications for prerequisites in the requested courses. All applicants in addition to meeting the qualifications of the Graduate School must meet the special requirements of the product design program with regard to design capabilities and professional competence.

SELECTED ADVANCED UNDERGRADUATE COURSES

PD 400 Intermediate Product Design (Series). *Preq.: DF 102. 6(0-9) F,S.*

PD (TX) 471 Textile Design I. *Preqs.: PD (TX) 271, PD (TX) 272. 3(2-2) S.*

PD (TX) 472 Textile Design II/Internship. *Preq.: PD (TX) 471. 3 Sum.*

PD (TX) 473 Textile Design III. *Preqs.: PD (TX) 473. 3(2-2) F.*

PVD 400 Intermediate Visual Design (Series). *Preq.: DF 102. 6(0-9) F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

PD 511 Materials and Processes V. *Preq.: Grad. standing. 3(2-2) F.* Advanced studies in mass of products. Emphasis is placed on material search and process selection in relation to cost, function, human factors, form, finishes and joining methods. An analysis of paper, wood, metal and manufacturing processes utilized in the production of mass-produced products.

PD 512 Materials and Processes VI. *Preq.: Grad. standing. 3(2-2) S.* Advanced studies in mass production processes and their influence on design and development of products. Emphasis is placed on material search and process selection in relation to cost, function, human factors, form, finishes and joining methods. An analysis of plastics and rubber and the related manufacturing processes utilized in the production of mass-produced products.

PD 541, 542 Advanced Visual Design I, II. *Preqs.: ARC 400, LAR 400, PD 400 or PVD 400; waiver of prerequisite is at the discretion of the instructor. 6(3-9) F,S.* Application of previous studies in design and visual communications to a wide variety of visual problems presented by our physical environment.

PD 591 Special Seminar. *Preq.: Grad. standing. 1-3 F,S.* Seminars on subjects of current interest in design which are presented by persons not part of the regular faculty.

PD 592 Special Topics. *Preq.: Grad. standing. 2-3 F,S.* Topics of current interest to the programs in the School of Design offered by faculty in the School. Subjects offered under this number are normally used to test and develop new courses.

PD 595 Independent Study. *Preq.: Grad. standing. Max. 6 F,S,Sum.* Special problems in various aspects of design developed under the direction of a faculty member on a tutorial basis.

FOR GRADUATES ONLY

PD 600 Advanced Product Design (Series). *Preq.: PD 400 or grad. standing or CI. 6(0-12) F,S.* Advanced studies in product design and development concerned with various social/economic age groups, various unlimited production systems, and various natural and synthetic materials. Special emphasis is given to problem identification, program formulation and application of advanced design methods. All problems will be of an individual nature. Approval for cooperative work must be secured from the instructor.

PD 631, 632 Advanced Concepts in Product Engineering. *Preqs.: PD 600, grad. standing. 3(3-0) F,S.* Group investigation of advanced concepts in product design with emphasis on engineering. Engineering principles play an important role in the design of useful products. The scope of this course will include mass movement of persons as well as the designs of consumer products. The field of transportation and consumer products are fast changing to satisfy the needs of the present and future generations. The product designer is to be made aware of these needs by special investigations into future technologies and future material developments.

PD 690, 691 Special Topics in Product Design. *Preq.: Grad. standing. 1-6 F,S.* An investigation of special topics in product/visual design of a particular interest to advanced students under the direction of a faculty member on a tutorial basis. Credits and contents will vary with each student.

Psychology

GRADUATE FACULTY

Professor P. W. Thayer, Head

Professors: J. W. Cunningham, D. W. Drewes, T. E. LeVere, S. E. Newman, R. G. Pearson, J. L. Wasik, B. W. Westbrook; *Adjunct Professor:* R. W. Oppenheim; *Professors Emeriti:* K. L. Barkley, H. M. Corter, J. C. Johnson, H. G. Miller; *Associate Professors:* J. L. Cole, J. W. Kalat, K. W. Klein, J. E. R. Luginbuhl, D. H. Mershon, F. J. Smith, S. S. Snyder; *Adjunct Associate Professors:* B. C. Ball, B. F. Corder, J. L. Howard, M. N. Wiebe; *Associate Professors Emeriti:* J. W. Magill, M. H. Pitts, R. F. Rawls; *Assistant Professors:* D. Gray, T. M. Hess, P. E. Horan, E. F. Kelsey, L. A. Makoid, S. B. Pond III, D. Scott-Jones, N. W. Walker;

Visiting Assistant Professor: N. D. LeVere; *Adjunct Assistant Professors:* R. T. Hornak, C. L. Kronberg, L. S. Taylor

The Department of Psychology offers courses of study leading to the Master of Science and Doctor of Philosophy degrees. Specialization in applied developmental-educational psychology, experimental psychology, ergonomics, industrial-organizational and vocational psychology, social psychology and human resource development is available.

A minimum of 30 semester hours of graduate credit is required for the master's degree. Though no minimum number of additional hours is required for the doctoral degree, the student may expect to take 30 or more additional semester hours of graduate credit. The actual graduate program for each master's and doctoral student is tailored to the needs, interests and accomplishments of the individual. Admission requirements for the beginning graduate student in psychology are satisfactory grades in all undergraduate work and at least a "B" average in undergraduate psychology courses and in the undergraduate major, satisfactory scores on the Graduate Record Examination including the Advanced Test in psychology and the Miller Analogies Test and three satisfactory letters of recommendation in regard to quality of work and character. It is possible to enter the program without undergraduate coursework in psychology but some preparation in experimental psychology, statistics and mathematics is desirable.

Admission requirements for students already possessing the master's degree who wish to obtain the doctorate in psychology are a minimum of a "B" average in their graduate work and a substantial background in psychology or related fields, satisfactory grades in undergraduate studies, satisfactory scores on the Graduate Record Examination including the Advanced Test in psychology (if the applicant's master's degree is in a field other than psychology, the Advanced Test score in that field and the Miller Analogies Test score should also be submitted) and three satisfactory letters of recommendation in regard to quality of work and character.

A limited number of research and teaching assistantships and fellowships are available to qualified graduate students.

SELECTED ADVANCED UNDERGRADUATE COURSES

PSY 475 Child Psychology. *Preq.: PSY 200 or 304. 3(3-0) F.*

PSY 476 Psychology of Adolescent Development. *Preq.: Jr. standing. 3(3-0) F,S.*

PSY 491 Special Topics in Psychology. *Preq.: PSY 200. 3(3-0) F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

PSY 500 Perception. *Preq.: Grad. standing. 3(2-2) F.* A survey of the anatomy and physiology of the visual system and their relationship to such processes as sensory adaptation, binocularity and color vision. Modern quantitative approaches to the problems of detection, discrimination and psychophysical scaling. Examination of the chief determiners of visual perception, including both stimulus variables and such organismic variables as learning, motivation and attention. The discussion of perceptual theory and processes will emphasize several topics in two- and three-dimensional spatial perception. Mershon

PSY 501 Introduction to Graduate Study in Psychology. *Preq.: Grad. standing in PSY. 1(1-0) F.* Orientation to graduate study in psychology. Library and computer systems. Faculty research and teaching interests. Special research facilities and populations. Standards for research with human and infrahuman subjects. Ethical principles of American Psychological Association. Generic and specialty guidelines for providers of psychological services. North Carolina Licensing Law and supporting rules. Psychology as science, discipline and profession. Newman

PSY 502 Physiological Psychology. *Preq.: Twelve hours of PSY including PSY 200, 300, 310. 3(3-0) F.* First of two-semester sequence concerned with the physiological foundations of behavior. The emphasis in this first course is basic vertebrate neuroanatomy and neurophysiology. LeVere

PSY 503 Comparative Psychology. *Preq.: 9 hours in PSY or animal behavior or CI. 3(3-0) S.* A study of animal behavior, species differences in behavior and biological determinants of behavior. An emphasis on the careers and research styles of some eminent comparative psychologists, for example, Richter, Tinbergen, Harlow, Stein and Rensch. Kalat

PSY 504 Advanced Educational Psychology. *Preq.: Six hours of PSY. 3(3-0) F, S.* A critical appraisal of current psychological findings that are relevant to educational practice and theory. Makoid

PSY 505 History and Systems of Psychology. *Preqs.: PSY 200, 300, 310, 320 or CI or grad. status. 3(3-0) S.* The aim of this course is to acquaint students with the history of psychology and psychological systems and to give students some practice in taking different approaches to a particular problem area. Cole

PSY 510 Learning and Motivation. *Preq.: Grad. standing or PBS status. 3(3-0) S.* A systematic analysis of some of the major classes of variables determining behavioral change. Learning variables are analyzed within their primary experimental setting, and emphasis is upon the diversity of the functions governing behavior change rather than upon the development of some comprehensive theory. Both learning and motivational variables are examined as they contribute to changes in performance within the experimental setting. Cole

PSY 511 Advanced Social Psychology. *Preq.: Grad. standing or PBS status. 3(3-0) F.* A survey of theory and research in social psychology through reading and discussion of primary source materials. In addition, the course will deal with issues of methodology, ethical questions in social psychological research and application of research findings to the world at large. Klein, Luginbuhl, Smith

PSY 514 Foundations of Behavioral Research. *Preqs.: Grad. standing, ST 507 and PSY 535 or equivalent. 3(3-0) F.* A course in scientific behavioral research, basically psychological in nature, designed to help students understand the fundamental nature of the scientific approach to problem solution. Technical and methodological problems are considered. The course emphasizes the controlled and objective study of the relations among phenomena, the scientific approach and the relations between a research problem and the design and methodology of its solution. Westbrook

PSY 520 Cognitive Processes. *Preq.: Grad. standing or PBS status. 3(2-2) F.* This course will emphasize the results from research on a number of complex processes (e.g., remembering, concept learning, problem solving, acquisition and use of language) and the theories that have been proposed to explain these results. Newman

PSY 530 Abnormal Psychology. *Preqs.: PSY 200, 370. 3(3-0) S.* The causes, symptomatic behavior and treatment of the major personality disturbances. Emphasis on theory, experimental psychopathology and preventive measures. Graduate Staff

PSY (ED) 531 Mental Retardation. 3(3-0) F,Sum. (See education.)

PSY 532 Psychological Aspects of Exceptionality. *Preq.: CI. 3(3-0) S,Sum.* The course is designed to give consideration to effects of severe deficiency (sensory, physical, mental, etc.) arising from any causes at any stage of life; the personal and social ramifications of these; and possible courses of intervention; as well as utilization of psychological theory and clinical information in interpreting probable implications. Research findings related to sensory deprivation, research needs and possible research projects will be discussed.

Graduate Staff

PSY 533 Biological Factors in Abnormal Behavior. *Preqs.: 6 hours of PSY and 6 hours of biology. 3(3-0) Alt. Sum.* Biological influences and predispositions in abnormal human behavior, including brain damage and disconnection syndromes, psychosomatic illnesses, anxiety and neurosis, manic-depressive disorder, schizophrenia and disorders of memory, eating, movement, sexual behavior and others. Assumes only a moderate biology background.

Kalat

PSY 535 Tests and Measurements. *Preq.: Six hours of PSY. 3(3-0) F,S.* A study of the principles of psychological testing including norms and units of measurement, elementary statistical concepts, reliability and validity. In addition, some attention is devoted to the major types of available tests such as general intellectual development, tests of separate abilities, achievement tests, measures of personality and interest inventories.

Westbrook

PSY (IE) 540 Human Factors in Systems Design. *Preq.: IE (PSY) 338 or IE 354; Coreq.: ST 507 or 515. 3(3-0) S.* Introduction to problems of the systems development cycle, including man-machine function allocation, military specifications, display-control compatibility, the personnel sub-system concept and maintainability design. Detailed treatment is given to man as an information processing mechanism.

Pearson

PSY 545 Fundamentals of Skill. *Preq.: Grad. standing or PBS status. 3(3-0) Alt. F.* Fundamentals of human perceptual, cognitive and sensory-motor abilities that are basic to skilled performance. Treatment of such topics as channel capacity, short-term memory, stress, fatigue, arousal theory, task taxonomy, skill acquisition, proficiency decrement, information feedback and performance analysis. Problems of attention, search, monitoring, tracking, complex tasks and skill maintenance.

Pearson

PSY (ED) 553 Community Service Agencies. 3(3-0) F,S. (See education.)

PSY 565 Organizational Psychology. *Preq.: Nine hours of PSY. 3(3-0) S.* A study of the application of behavioral science, particularly psychology and social psychology, to organizational and management problems.

Pond

PSY 566 Organization Development and Change. *Preq.: PSY 565. 3(3-0) S.* A survey of theory and research in organization development. Attention will be directed to: (1) methods of diagnosing the need for organizational change, (2) techniques currently used to implement and evaluate organizational change, (3) professional ethics and other issues dealing with the client-consultant relationship. Emphasis will be on developmental approaches originating from psychology and allied fields.

Pond

PSY 570 Theories of Personality. *Preq.: Grad. standing. 3(3-0) F.* A review of theories of personality, with emphasis on research, application in psychotherapy and measurement, principles involved in similarities and differences among them and development of a personal model.

Horan

PSY 571 Individual Intelligence Measurement. *Preq.: PSY 570. 3(3-0) S.* A practicum in individual intelligence testing with emphasis on the Wechsler Bellevue, Stanford-Binet, report writing and case studies.

Walker

PSY 572 Psychological Survey Operations. *Preq.: ST 507 or equivalent; Coreq.: ST 508 or equivalent. 3(3-0) S.* Emphasis is on application of survey operational methods to problems of interest to psychologists in governmental, institutional and industrial settings. Course is designed to provide competency in questionnaire construction, data collection, design and analysis procedures and report writing. The class will design, conduct and analyze a survey on topic of their own selection in the area of psychology. Klein

PSY 575 Behavior Modification. *Preq.: Grad. standing or PBS status. 3(2-2) S.* The course will deal with the application of behavior modification techniques. Balanced emphasis will be placed upon theoretical foundations, ethical considerations, acquisition of skills and practicum experiences. Specifically, course content will consist of methods of applying laws derived from the psychology learning laboratory such as reinforcement schedules, contingency specifications and objective behavioral analyses to the solution of behavioral problems in practical situations. Enrollment limited to 12 students; priority (1) school psychology, (2) other psychology graduate students. Graduate Staff

PSY 576 Developmental Psychology. *Preq.: Nine hours of PSY, including PSY 475 or PSY 476. 3(3-0) F.* A survey of the role of growth and development in human behavior, particularly during the child and adolescent periods. This course will pay particular attention to basic principles and theories in the area of developmental psychology. Hess, Snyder

PSY 577 Adolescent Development. *Preq.: 6 hours in PSY or CI. 3(3-0) F, Alt. Sum.* Current theories and research on the three ages of adolescence (the Child-Adolescent, the Adolescent, the Adult-Adolescent). Topics include: physical growth and health, cognitive changes, relationships with peers, parents and teachers, quest for identity and independence, cultural variations, morality, sexuality, drug abuse and delinquency. Makoid, Snyder

PSY 578 Individual Differences. *Preq.: Six hours of PSY. 3(3-0) Alt. S.* The objective and quantitative investigation of individual differences in behavior. The course deals with the following questions: What is the nature and extent of individual differences? What can be discovered about their causes? How are the differences affected by training, growth and physical conditions? In what manner are the differences in various traits related to one another or organized? Westbrook

PSY 579 Adult Development and Aging. *Preq.: PSY 576 or equivalent. 3(3-0) Alt. F.* Critical examination of theory and research associated with the study of normal adult development and aging. Topics include: methodological issues; cognitive and intellectual development; changes in learning and memory; personality and emotional development; socialization processes; psychophysiological and biological factors. Hess

PSY 591 Special Topics in Psychology. *Preq.: 6 hours of PSY; Coreq.: 3 hours of ST. 1-3 F,S.* Course will provide opportunity for exploration in depth of advanced areas and topics of current interest. Graduate Staff

PSY 592 Area Seminar in Experimental Psychology. *Preq.: Grad. standing or PBS status. 1-3, Max. 6. F,S.* The following topics will be dealt with: (1) the development of experimental psychology as an area of inquiry, (2) methods of inquiry, (3) contemporary issues, (4) ethical questions, (5) relationship to other areas within psychology. Graduate Staff

PSY (IE) 593 Area Seminar in Ergonomics. *Preq.: Grad. standing or PBS status. 1(0-2), Max. 3. F.* Introduction to ergonomics as an area of study; historical aspects; contemporary issues; ethical questions; overview of campus research, facilities and courses in the area; consideration of information sources, financial support for research proposals and employment opportunities. Pearson

PSY 594 Area Seminar in Human Resources Development. *Preq.: CI. 1-3, Max. 6. F,S.* The following topics will be dealt with: (1) human resources development as an area of inquiry, (2) methods of inquiry, (3) contemporary issues, (4) ethical questions, (5) relationship to other areas within psychology. Drewes

PSY 595 Area Seminar in School Psychology. *Preq.: Grad. standing or PBS status. 1-3, Max. 6. F,S.* The following topics will be dealt with: (1) the development of school psychology as a professional area, (2) methods of inquiry, (3) scientific and theoretical bases, (4) contemporary issues, (5) ethical questions, (6) relationship to other areas within psychology. Graduate Staff

PSY 596 Area Seminar in Social Psychology. *Preq.: Grad. standing. 1-3, Max. 6. F,S.* This course will deal with the following topics: (1) a survey of areas within social psychology, (2) methods of inquiry, (3) contemporary issues, (4) ethical questions, (5) the relation of social psychology to other branches of psychology, to other disciplines and to society and its problems. Graduate Staff

PSY 599 Research Problems in Psychology. *Preq.: CI. Credits Arranged. F,S.* Research project for graduate students supervised by members of the graduate faculty. Research to be elected on basis of interest of student and is not to be part of thesis or dissertation research. Graduate Staff

FOR GRADUATES ONLY

PSY 602 Physiological Psychology. *Preq.: PSY 502 and/or CI. 3(3-0) S.* PSY 602 is the sequel to PSY 502 and will concentrate on relating the neuroanatomy and neurophysiology studied in PSY 502 to overt observable behaviors such as sleep-waking, motivation-emotion and reflexive and learned behaviors. LeVere

PSY 605 Instrumental Learning. *Preqs.: PSY 510, 514. 3(3-0) S.* A systematic analysis of various experimental techniques and alternative data languages for the study of instrumental learning. Primary orientation will be upon what is happening in the experimental situation rather than upon theoretical explanations of the data. Special problems—for example, discrimination, avoidance chaining and reinforcement schedules—will be studied in depth. Various models for description of the data will be compared with special emphasis upon mathematical learning models. Cole

PSY 607 Advanced Industrial Psychology I. *Preqs.: Nine hours of PSY and ST or concurrent with statistics. 3(3-0) F.* Application of scientific methods to the measurement and understanding of industrial behavior. Drewes

PSY 608 Advanced Industrial Psychology II. *Preq.: PSY 607. 3(3-0) S.* Application of scientific methods to the measurement and understanding of industrial behavior. Drewes

PSY 610 Theories of Learning. *Preqs.: PSY 510, 514. 3(3-0) F.* The objectives of this course are to promote learning of the theories currently used to explain how learning and forgetting occur so that testable consequences of these theories can be derived and so that the theories and their testable consequences are capably written and spoken about. Cole

PSY 611 Social Psychology: Small Groups Research. *Preq.: PSY 511. 3(3-0) S.* Surveys the literature and research pertaining to social psychological processes in and between groups. Course content includes basic principles of group formation, role differentiation, communication, influence, norms, social exchange, equity, cooperation/conflict, decision making and pro-social behavior. Environmental factors affecting group behavior are also considered. In conjunction with each substantive topic, the suitable methodologies for research are considered. Graduate Staff

PSY 612 Attitudes. *Preq.: Six hours grad. PSY or CI. 3(3-0) F.* Theory and research in attitude formation and change; analysis of various persuasion paradigms employed in mass communication and group influence processes; study of individual attitudinal structures, resistance to persuasion, behavior as a precursor to attitude change; attitude behavior discrepancy, attitude measurement techniques and methodological considerations. Klein

PSY 620 Advanced Problems in Cognition. *Preq.: PSY 520 or CI. 3(3-0) S.* This seminar will provide the opportunity for exploring in depth problems and issues in memory, concept learning, problem solving, psycholinguistics and other areas in cognition. Newman

PSY 635 Psychological Measurement. *Preqs.: ST 507, 511 or equivalent, 12 hours of PSY. 3(3-0) F.* Theory of psychological measurement. Statistical problems and techniques in test construction. Cunningham

PSY (IE) 640 Skilled Operator Performance. *Preqs.: PSY 545, ST 507 or ST 515. 3(3-0) Alt. F.* Theories of the human operator are considered with regard to the classical problems of monitoring, vigilance and tracking. Factors such as biological rhythm, sleep loss, sensory restriction, environmental stress and timesharing are considered as they interact with and determine overall systems efficiency. Pearson

PSY 650 Vocational Psychology. *Preqs.: ST 507, PSY 514, 635 or equivalent. 3(3-0) Alt. F.* The study of the individual's vocational behavior and development through the years of choice and adjustment. An up-to-date review and synthesis of research and theory in the field of vocational psychology. Empirical studies and theoretical statements in the field are appraised and evaluated to determine what behavioral laws apply to vocational phenomena. Westbrook

PSY 672 Personality Measurement. *Preqs.: PSY 570, 571. 3(2-3) S.* Theory and practicum in individual personality testing of child and adults with emphasis on projective techniques, other personality measures, report writing and case studies. Walker

PSY 674 Psychological Intervention I. *Preqs.: PSY 672, 530 and CI. 3(2-2) F.* This course is designed to examine theories, research, techniques, ethics and professional responsibilities related to approaches to psychological intervention. Types of psychological intervention to be studied will include behavior modification, milieu approaches, crisis intervention techniques and group process methods, in addition to more intensive relationship approaches. A close integration of experiences, content and supervision will be emphasized in a variety of professional settings with a wide range of personal problems and age groups. Graduate Staff

PSY 675 Psychological Intervention II. *Preq.: PSY 674. 3(2-2) S.* The primary purpose of this course is to provide students opportunities to acquire information, conceptual frameworks, interpersonal skills and a sense of ethical responsibility, all of which are basic to their further development as practicing psychologists. A major effort in the course is made to help the student increase his interpersonal skills as a means of promoting the psychological growth and effectiveness of others. Graduate Staff

PSY 690 Seminar in Industrial Psychology. *3(3-0) S.* Scientific articles, analysis of experimental designs in industrial psychology and study of special problems of interest to graduate students in industrial psychology. Graduate Staff

PSY 691 Special Topics in Psychology. *Preqs.: Grad. standing, CI. 1-3 F.S.* Course will provide opportunity for exploration in depth of advanced topical areas which, because of their degree of specialization, are not generally involved in other courses; for example, multivariate methodology in psychology, computer simulation, mathematical model building. Some new 600-level courses will first be offered under this title during the developmental phase and as such may involve lectures and/or laboratories. Graduate Staff

PSY 693 Psychological Clinic Practicum. *Preqs.: Twelve hours in grad. PSY, which must include clinical skill courses PSY 571 and PSY 672 and/or CI. Max. 12 F.S.* Clinical participation in interviewing, counseling, psychotherapy and administration of psychological tests. Practicum to be concerned with adults and children. Horan, Kelsey, Walker

PSY 696 Advanced Problems in Perception. *Preqs.: PSY 500, 514. 3(2-2) S.* Advanced topics in perception will be the subject matter of this course. Topics will include a survey and analysis of contemporary trends in perceptual research and theory. Mershon

PSY 697 Advanced Seminar in Research Design. *Preqs.: Nine hours of statistical methods and research or CI, advanced grad. status. 3(3-0) F.* This course will be designed as a seminar-type course, with topics selected each semester in accordance with the interests and needs of the students. Attention will be given to the research strategies that underlie educational and psychological research, to the development of theoretical constructs, to a critical review of research related to problems in which the students are interested, and to a systematic analysis and critique of research problems in which the students are engaged. Graduate Staff

PSY 698 Internship in Psychology. *Preqs.: Master's degree in PSY and approval of advisory committee. 1-12 F.S.* Supervised work experience in an appropriate setting with professional supervision in the field from a doctoral level psychologist with credentials and/or experience in the appropriate specialty in psychology. Experience will consist of full time for one semester or half time for an academic year or equivalent time. Horan, Kelsey, Walker

PSY 699 Thesis and Dissertation Research. *Preqs.: Grad. standing, CI. Credits arranged. F.S.* Individual research on a thesis or dissertation problem; a maximum of six credits is allowed toward the master's degree, but any number toward the Ph.D. degree. Graduate Staff

Recreation Resources Administration

GRADUATE FACULTY

Professor M. R. Warren, Head

Professor: R. E. Sternloff; Professors Emeriti: T. I. Hines, W. E. Smith; Associate Professors: H. A. Devine, P. S. Rea, C. D. Siderelis; Associate Professors Emeriti: G. A. Hammon, L. L. Miller; Assistant Professors: D. F. Culkin, D. D. Tarbet; Visiting Assistant Professor: L. E. Abbas; Adjunct Assistant Professor: H. K. Cordell

The Department of Recreation Resources Administration offers programs of study leading to the Master of Science and Master of Recreation Resources degrees. The programs are based on an interdisciplinary approach and are designed to meet the problems and opportunities posed by changing social forces which affect the recreation profession. Students pursuing these degrees will have an opportunity to develop an understanding of the relationship between recreation and disciplines such as forestry, wildlife management, horticulture, landscape design, conservation, economics and business, politics, sociology and anthropology.

The Master of Science degree is designed to enhance in advanced students scholarly development and a more adequate comprehension of the requirements

and responsibilities essential for independent research. A student will be required to complete a minimum of 30 hours of graduate work. The program will consist of a major and minor field of study. The minor may be concentrated wholly in a different discipline or may consist of courses selected from the offering of two departments. In either case, the minor field must constitute a unified pattern and must contribute to the student's education in the major field.

Each candidate for the Master of Science degree will be required to complete a thesis representing an original investigation as a part of the minimum requirements for the degree.

The Master of Recreation Resources degree is designed for students who are interested in the more advanced applications of management and organization principles in the operation of recreation and park agencies. Requirements for the Master of Recreation Resources degree include a minimum of 36 hours of course work. In lieu of a thesis the student will be required to complete additional departmental course work.

SELECTED ADVANCED UNDERGRADUATE COURSES

RRA 442 Recreation and Park Interpretive Services. *Preq.: Jr. standing. 3(2-3) F,S.*

RRA 451 Facility and Site Planning. *Preq.: RRA 341. 3(2-3) F,S.*

RRA 453 Administrative Policies and Procedures. *Preq.: RRA 359. 3(3-0) F,S.*

RRA 454 Recreation and Park Finance. *Preqs.: Six hours of RRA courses and sr. standing. 3(3-0) F,S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

RRA 500 Theories of Leisure and Recreation. *Preq.: Nine hours of RRA courses. 3(3-0) F.* Analysis of leisure and recreation and a study of their origin and development as revealed by man's behavioral patterns. Interpretation of the influence and social significance of leisure and recreation concepts on contemporary American culture and their implications on future recreation thought and action. Culkin, Warren

RRA 501 Research Methods in Recreation. *Preqs.: ST 311 and nine hours of RRA courses. 3(3-0) S.* Examination and understanding of advanced scientific investigative methods in their application toward explaining recreation and leisure behavioral phenomena and for the resolution of recreation management problems. Siderelis

RRA (EB) 503 Economics of Recreation. *Preq.: EB 301 or 401. 3(3-0) F.* The principal emphasis will be on identity and importance of economic information for planning. The market mechanism and government will be examined as they affect and interact to affect allocation of resources to recreation, distribution of recreation services and behavior of recreationists. Other topics include demand analysis, economics of planning, cost/benefit analysis, secondary economic impacts, public decision making, externalities, public finance and supply considerations in urban and rural recreation situations. Devine

RRA 504 Recreation and Park Data Systems. *Preqs.: CSC 200, ST 311; Coreq.: RRA 453. 3(3-0) F.* This course includes the analysis of such topics as the identification of maintenance, operation and service delivery work areas in recreation and park agencies for system applications; development of reporting structures; recreation and maintenance activity scheduling; system monitoring; system implementation evaluation. Siderelis

RRA 505 Quantitative Techniques for Recreation and Natural Resource Management. *Preqs.: CSC 200, ST 311. 3(3-0) S.* A review of the application of specific management science techniques to recreation and natural resource management. Gravity, optimization, simulation and other modeling procedures will be discussed through a case study approach. The primary emphasis of the course is exposure to techniques and problem formulation rather than development of theoretical bases or computational methodologies. Devine

RRA 520 Resort Management and Operations. *Preqs.: EB 401 or RRA 503. 3(3-0) S.* An examination of the theory and practical applications of travel planning, accommodations management and food/beverage operations in the resort industry. Graduate Staff

RRA 538 Recreation for Special Populations. *3(3-0) S.* Emphasis on the leisure concerns of deprived groups with exposure to the status, problems and community service needs of special populations found in most American communities. Special populations include the physically disabled, the mentally retarded, the aging and the economically deprived. Sternloff

RRA (LAR) 562 Computer Cartography. *Preq.: Grad. standing or CI. 3(3-0) S.* An introduction to the application of computers and associated analytic technology to problems in natural resource planning and management. The course will emphasize the use of automated mapping and display procedures in land use decision making and will involve the student in first-hand experiences with a number of different procedures and computer hardware configurations. This is not a general course in computer graphics and will deal exclusively with natural resource management applications. Devine

RRA 580 Current Issues in Recreation Resources. *Preqs.: Grad. standing, CI. 1-3 S.* An examination of current issues in recreation resources. Course content varies as changing conditions require new approaches to emerging problems. Graduate Staff

RRA 591 Recreation Resources Problems. *Preq.: Advanced undergrad. or grad. status. 1-4 F/S.* Assigned or selected problems in the field of recreation administration, planning, supervision, maintenance, operations, financing or program. Special research problems selected on basis of interest of students and supervised by members of the graduate faculty. Graduate Staff

RRA 595 Special Topics in Recreation Resources. *Preqs.: Grad. standing, CI. 1-3 F/S.* Special topics in various aspects of recreation resources are developed under direction of a graduate faculty member on a tutorial basis. Subjects offered under this course listing are also used to test and develop new courses. Graduate Staff

FOR GRADUATES ONLY

RRA 691 Seminar in Recreation Administrative Policies. *Preq.: RRA 501 or equivalent. 2(0-4) F.* Advanced course in administrative principles; students to individual and group research, under supervision, in specific administrative categories of study in the field of recreation. Independent study and research required of students who must develop written and oral presentations for critical analysis by graduate students and faculty. Rea

RRA 692 Advanced Problems in Recreation. *Preq.: Twelve hours of RRA courses. Credits Arranged. F/S.* Directed research in a specialized phase of recreation other than a thesis problem. Graduate Staff

RRA 699 Research in Recreation. *Preq.: Twelve hours of RRA courses. Credits Arranged. F/S.* Original research preliminary to writing a master's thesis. Graduate Staff

Sociology and Anthropology

GRADUATE FACULTY

Professor R. C. Wimberley, Head

Professors: W. B. Clifford, V. E. Hamilton, T. N. Hobgood Jr., G. C. McCann, C. P. Marsh, R. L. Moxley—*Graduate Administrator*, M. M. Sawhney—*Assistant Head of the Department*, E. M. Suval, M. E. Volland, J. N. Young; *Professors Emeriti:* L. W. Drabick, H. D. Rawls; *Associate Professors:* R. C. Brisson, A. C. Davis, L. R. Della Fave, S. K. Garber, V. A. Hilday, G. S. Nickerson, J. G. Peck, P. N. Reid, M. D. Schulman, R. J. Thomson, O. Uzzell, M. L. Walek, J. M. Wallace, M. T. Zingraff; *Associate Professor Emeritus:* C. V. Mercer; *Assistant Professors:* M. P. Atkinson, C. G. Dawson, R. S. Ellovich, G. D. Hill, F. M. Howell, T. M. Hyman, J. C. Leiter, S. C. Lilley, I. Rovner, K. M. Troost, E. M. Woodrum

ASSOCIATE MEMBER OF THE DEPARTMENT

Professor R. D. Mustian

The Department of Sociology and Anthropology offers programs of study in sociology leading to the advanced degrees of Master of Sociology, Master of Science and Doctor of Philosophy. The core program includes sociological theory, research methods and quantitative analysis. Other major areas of concentration include community and regional development, demography and ecology, deviance and criminology, sociology of agriculture and rural sociology, sociology of development and social change, social organization, social psychology and sociology of the family.

The Master of Science and Doctor of Philosophy degrees are oriented to the basic and applied science of sociology. Special attention is given to sociological skills for analyzing social factors and policies affecting informal groups, formal organizations, families, communities, regions, nations and international development. The Master of Sociology is designed for applied sociology careers in local, state and federal agencies; management and administration; human service delivery; program development and evaluation; and the teaching of sociology in secondary schools. The program focuses on the application of sociological theory, methods and research to social issues and problems. A practicum gives the student experience in an agency/organization.

The department also offers a minor in cultural anthropology at the Master's level. Graduate courses are designed to give a broad background in major concepts of cultural anthropology with emphasis on theory. These offerings may be supplemented with courses in geographic areas and methodology at the 400 level.

Computer facilities are available to graduate students and faculty in the department as described under "Computing Facilities." Graduate students on assistantships and fellowships are normally provided office facilities. Research opportunities reflect the wide range of interests of the graduate faculty and the imagination of the students themselves. The department also has a statewide extension focus in applied sociology.

SELECTED ADVANCED UNDERGRADUATE COURSES

- ANT 416 Research Methods in Cultural Anthropology.** *Preq.: Six hours ANT. 3(3-0).*
- ANT 420 Biological Bases for Human Social Behavior.** *Preq.: ANT 251, or BS 100 or 105, GN 301, or equivalent. 3(3-0).*
- ANT 498 Special Topics in Anthropology.** *Preq.: Six hours of SOC/ANT. 1-6.*
- SOC 402 Urban Sociology.** *Preq.: SOC 202. 3(3-0).*
- SOC 410 Formal Organizations.** *Preq.: SOC 202. 3(3-0).*
- SOC 414 Social Class.** *Preq.: SOC 202. 3(3-0).*
- SOC 415 Social Thought.** *Preq.: SOC 202. 3(3-0).*
- SOC 416 Research Methods.** *Preqs.: Sr. standing, ST 311, or CI. 3(3-0).*
- SOC 418 Analysis of School-Community Relations.** *Preq.: SOC 202, or 318, or 311, or ED 344. 3(2-2).*
- SOC 420 Sociology of Corrections.** *Preqs.: SOC 306 and PS 311. 3(1-2).*
- SOC 425 Juvenile Delinquency.** *Preq.: SOC 202, SOC 301 desirable. 3(3-0).*
- SOC 440 Social Change.** *Preq.: SOC 202. 3(3-0).*
- SOC 441 Social Change in Asia.** *Preq.: SOC 202. 3(1-1).*
- SOC 490 Senior Seminar in Sociology.** *Preqs.: Sr. standing and consent of department. 3(3-0).*
- SOC 498 Special Topics in Sociology.** *Preq.: Six hours SOC above 200 level. 1-6.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ANT 501 Advanced Survey of Cultural Anthropology. *Preq.: Grad. standing or PBS status. 3(3-0).* An intensive examination of the field of cultural anthropology. As a foundation course for subsequent graduate work in anthropology, emphasis will be placed on main currents in anthropological thinking and research
Graduate Staff

ANT 505 Comparative Social Organization. *Preq.: ANT 501 or 6 hours in Cultural Anthropology. 3(3-0).* This course will focus on an analysis of forms of social organization in both technologically simple and complex societies from several analytical perspectives. Discussion of kinship theory; the relationship of social organization to systems such as the economic, political and religious; and an examination of modern development in social organization research will be stressed.
Graduate Staff

ANT 508 Culture and Personality. *Preq.: ANT 501 or 6 hours in Cultural Anthropology. 3(3-0).* The course focuses on the interplay between cultural norms and the enculturation process. From a cross-cultural perspective, it examines the process by which cultural norms are transmitted and learned, as well as the effect of culture change on the individual. The historical development of the field as well as contemporary trends are also discussed in both theoretical and applied contexts.
Graduate Staff

ANT 511 Anthropological Theory. *Preqs.: ANT 501 or 6 hours in Cultural Anthropology. 3(3-0).* Approaches theory from both an historical and contemporary point of view. Emphasizes the key anthropological concept of culture and its significance for understanding man and his works. Graduate Staff

ANT 512 Applied Anthropology. *Preq.: ANT 252 or CI. 3(3-0).* Includes a review of the historical development of applied anthropology and a study of anthropology as applied in government, industry, community development, education and medicine. The processes of cultural change are analyzed in terms of the application of anthropological techniques to programs of developmental change. Graduate Staff

ANT 591 Special Topics in Anthropology. *Preq.: ANT 501 or equivalent. 1-6.* This course is designed to provide the opportunity for students to investigate in depth some particular topic in anthropology. Course content and mode of study will vary, reflecting current student needs and interests. Topics will be determined by the faculty member(s) and student. Graduate Staff

SOC 501 Leadership. *Preq.: SOC 202 or equivalent. 3(3-0).* Leadership in various fields of American life; analysis of factors associated with it; techniques of leadership. Stresses recreational, scientific and executive leadership procedures. Graduate Staff

SOC 502 Society, Culture and Personality. *Preq.: SOC 202 or equivalent. 3(3-0).* Studies human personality from its origins in primary groups through its development in secondary contacts and its ultimate integration with social norms. Explores comparative anthropological materials but places emphasis on the normal personality and individual adjustment to our society and culture. Dynamics of personality and character structure analyzed in terms of society's general culture patterns and social institutions. Graduate Staff

SOC 503 Contemporary Sociology. *Preq.: Grad. standing or PBS status. 3(3-0).* An overview of the current status of sociological theory and research. Introduction to contemporary sociological thinking and research. Graduate Staff

SOC 504 Education in Modern Society. *Preqs.: SOC 202, 301 or equivalent. 3(3-0).* Places varying emphasis on the historical development of education in the United States, cross-cultural comparisons of educational structure and function, professionalization of educators, investigation of the ecological factors affecting education, effects of group processes upon learning and the effects of social processes and changes upon the educational institution. Graduate Staff

SOC 505 Medical Sociology. *Preq.: Six credits in SOC or grad. standing or PBS status. 3(3-0).* Advanced sociological analysis of health care organizations and their systemic linkage to other community institutions. Measurement of health and illness and their social significance. Applications of sociological and social-psychological theories to practitioner-client relationships and interaction. Implications of alternative models of health care provision. Graduate Staff

SOC 506 The Sociology of Rehabilitation. *Preq.: Grad. standing or PBS status. 3(3-0).* Students engage in individual research projects on a specific handicap, a rehabilitation process or a rehabilitative agency or subagency. Lectures and discussions furnish perspective concerning rehabilitation work in process while student pursues a specialized interest. Emphasizes sociological methods and techniques applicable to above aspects of social behavior. Graduate Staff

SOC 507 Social Movements. *Preq.: SOC 503 or 6 hours of SOC or social psychology. 3(3-0).* Major topics include: the nature and variety of social movements; conditions affecting the emergence of social movements; the structure of social movements; and the relationship be-

tween social movements, social conflict and social change. While the primary emphasis will be conceptual and theoretical, a number of social movements both past and contemporary will be examined within this framework. Similarly, research issues relative to social movements will be examined.

Graduate Staff

SOC 509 Population Problems. *Preq.: SOC 202 or equivalent. 3(3-0).* Examines population growth, rates of change and distribution. Emphasizes functional roles of population, i.e., age, sex, race, residence, occupation, marital status and education. Population dynamics are stressed: fertility, mortality and migration. Population policy is analyzed in relation to national and international goals stressing a world view.

Graduate Staff

SOC 510 Industrial Sociology. *Preq.: SOC 202 or equivalent. 3(3-0).* Industrial relations are analyzed as group behavior with a complex and dynamic network of rights, obligations, sentiments and rules. This social system is viewed as an interdependent part of total community life. The background and functioning of industrialism are studied as social and cultural phenomena and its social problems are analyzed.

Graduate Staff

SOC 511 Sociological Theory. *Preqs.: Six hours SOC and grad. standing or PBS status. 3(3-0).* The interdependence of theory and method; the major theoretical and methodological systems. Examines selected cases of research in which theory and method are classically combined.

Graduate Staff

SOC 512 Family Analysis. *Preq.: SOC 202 or equivalent. 3(3-0).* Examines the basic theoretical and methodological framework in sociology within which contemporary family research is conducted.

Graduate Staff

SOC 513 Community Organization and Development. *Preq.: SOC 202 or equivalent. 3(3-0).* Community organization is viewed as a process of bringing about desirable changes in community life. Community needs and resources are studied. Democratic processes in community action and principles of organization are stressed, along with techniques and procedures. Roles of lay and professional workers are analyzed.

Graduate Staff

SOC 514 Developing Societies. *Preq.: Six hours SOC or ANT or grad. standing or PBS status. 3(3-0).* Defines major problems posed for development sociology and explores the social barriers and theoretical solutions for development set forth with regard to the newly-developing countries. Significant past strategies reviewed and main themes in current development schemes presented. Untested strategies for the future proposed and discussed. These problems are examined in their national and international contexts.

Graduate Staff

SOC 515 Deviant Behavior. *Preq.: Six hours SOC or ANT or grad. standing or PBS status. 3(3-0).* Topics include: the inevitability of deviance and its social utility; cross-cultural variations in appearance and behavioral cues for labeling the deviant; descriptive and explanatory approaches to kinds and amounts of deviance in contemporary American society; social change, anomie and social disorganization theories; the process of stigmatization; formal and informal societal responses to deviance and the deviant; social action implications.

Graduate Staff

SOC 516 Social Control. *Preq.: Six hours SOC above 200 level or grad. standing or PBS status. 3(3-0).* The need, functions, utilization and effects of both informal and formal social control mechanisms are examined. Theoretical perspectives on social control and the empirical support for these positions are emphasized and critically evaluated.

Graduate Staff

SOC (PS) 517 The Police Bureaucracy in a Democratic Society. *3(3-0).* (See political science and public administration.)

SOC 520 Sociology of Religion. *Preq.: SOC 202 or equivalent or grad. standing or PBS status. 3(3-0).* Alternative theoretical analyses are presented for religious beliefs, practices and organizations and the relationships between these and other social phenomena. The utility and deficiencies of each conceptual framework are assessed through general applications and case studies. Major research findings in this classical field of sociology are reviewed. Contemporary trends and issues concerning religion in society are studied.

Graduate Staff

SOC 523 Sociological Analysis of Agricultural Land Tenure Systems. *Preq.: Three hours SOC. 3(3-0).* A systematic sociological analysis of the major agricultural and land-tenure systems of the world with emphasis on problems of U.S. family farm ownership and tenancy.

Graduate Staff

SOC 533 Theory of Human Communication Behavior. *Preqs.: Six hours SOC or social psychology and grad. standing or PBS status. 3(3-0).* The behavioral science approach to understanding human communication which is treated as a basic social psychological process in which communication events are analyzed in terms of their effects on individual, interpersonal and group behavior. Surveys theory, research methods and empirical findings. Communication behavior as a mediating mechanism in social interactions.

Graduate Staff

SOC 534 Agricultural Organizations and Movements. *Preqs.: Three hours SOC, American history, American government or a related social science or consent of department. 3(3-0).* A history of agricultural organizations and movements in the United States and Canada principally since 1865, emphasizing the Grange, the Farmers' Alliance, the Populist revolt, the Farmers' Union, the Farm Bureau, the Equity societies, the Nonpartisan League, cooperative marketing, government programs and present problems.

Graduate Staff

SOC 541 Social Systems and Planned Change. *Preq.: Three hours SOC. 3(3-0).* An examination of social systems within the framework of both functional theory and conflict theory, with particular emphasis upon system change and the planning of social change.

Graduate Staff

SOC 555 Social Stratification. *Preq.: Six hours SOC. 3(3-0).* The theoretical background, methodological approaches and analysis of the consequences of systems of stratification. Emphasizes the static and dynamic qualities of stratification systems on relations within and between societies. Attention to the integrative and divisive quality of stratification as it is expressed in life styles, world views, etc.

Graduate Staff

SOC 560 Racial and Cultural Contacts. *Preq.: Six hours SOC or CI. 3(3-0).* 1) Examines intergroup relations as a legitimate concern of the social sciences, 2) Appraises cross-cultural data drawn from a variety of situations wherein race and ethnicity figure in a significant manner, 3) Attempts to interpret data by delineating observable patterns, trends and relationships.

Graduate Staff

SOC 565 Sociology and General Systems Theory. *Preqs.: Six hours SOC, one ST course. 3(3-0).* Examines the basis of general systems theory and its application in the sociological fields. Emphasizes the philosophical nature of systems theory and its potential as an alternative conceptualization to mechanistic and organismic models. Scrutinizes the underlying basis of systems theory; cybernetics as models of change and control; learning and equilibrium; information theory as models of choice and selection; decision theory and game theory.

Graduate Staff

SOC 570 Commitment. *Preq.: Six hours SOC. 3(3-0).* The process of commitment and its strength is covered for several theoretical views as applicable to collective behavior, social movements, the sociology of religion, political sociology, deviance, attitudes, decision making, dissonance, structural effects and other topics. An aim is to construct propositions and testable models of the commitment process.

Graduate Staff

SOC (EB) 574 The Economics of Population. *3(3-0).* (See economics and business.)

SOC 590 Applied Research. *Preq.: SOC 202 or equivalent. 3(3-0).* Studies research process with emphasis upon its application to action problems. The development of research design to meet action research needs is stressed. Graduate Staff

SOC 591 Special Topics in Sociology. *Preq.: CI. 1-6.* An examination of current problems organized on a lecture-discussion basis. Course content varies as changing conditions require new approaches to emerging problems. Graduate Staff

SOC 592 Demographic Structure and Processes. *Preq.: SOC 509 or equivalent. 3(3-0).* Explores in depth the major demographic variables (size, composition and distribution) and basic demographic processes (fertility, mortality and migration). Attention to theoretical and methodological considerations as well as to current substantive knowledge. Specific course content varies depending upon student needs and interests. Graduate Staff

SOC 595 Practicum in Sociology. *Preqs.: Grad. standing in the Master of Sociology program and 9 hours of SOC at the 500-600 level. 3-6.* Opportunity for student under the supervision of graduate advisory committee chairman and organization/agency supervisor to develop and demonstrate competency in the area of graduate specialization through application of sociological knowledge to practical problems facing the organization/agency. Graduate Staff

FOR GRADUATES ONLY

SOC 601 Urban Ecology. *Preq. SOC 509. 3(3-0).* The course involves an historical approach to the development of the field as well as an analysis of the present state of the field. Because of the range of subject matter subsumed under the topic of ecology, the linkages between sociology and other disciplines concerning themselves with the subject will be delineated and examined. Graduate Staff

SOC 611 Research Methods in Sociology. *Preqs.: SOC 416, ST 311 or equivalent. 3(3-0).* Designed to give the student a mature insight into the nature of scientific research in sociology. Assesses the nature and purpose of research designs, the interrelationship of theory and research, the use of selected techniques and their relation to research designs and the use of modern tabulation equipment in research. Graduate Staff

SOC 612 Scaling and Indexing for Social and Behavioral Data. *Preqs.: ST 311, SOC 416 or equivalent. 3(3-0).* A basic introduction to the theory of measurement and scaling and to types of simple and composite measures used in the social and behavioral sciences. The development and utility of simple and composite indexes, paired comparison, equal appearing interval, summated rating cumulative, factor, latent structure and self-anchoring scales will be examined by means of problems and examples. Graduate Staff

SOC 613 Theory of Mass Communication. *Preq.: SOC 533 or equivalent. 3(3-0).* This course provides the advanced student in the social sciences with an opportunity to examine the emerging body of theory and research in the field of mass communications. Course content will treat: (1) the systems character of mass communication, (2) social communication at the individual and group level, (3) persuasive communication and social control, (4) communication and opinion change and (5) communication and societal development. In addition to the theoretical and methodological underpinnings drawn from the behavioral sciences, the course will examine contributions from the communication arts and applied communications. Graduate Staff

SOC 615 Research on Crime and Deviance. *Preq.: SOC 515 or equivalent. 3(3-0).* Major topics include: an examination of conceptual problems and research issues and methods in the study of crime and deviance; an assessment of current research on crime causation and

deviance processes; an examination of research on social control processes and agencies; and an assessment of social action and evaluative research. A variety of substantive topics will be dealt with in the context of the above topical areas including: delinquency, drug usage, mental illness, obesity, stuttering, suicide, prostitution, homicide and rape. Graduate Staff

SOC 621 Social Psychology. *Preq.: Six hours SOC. 3(3-0).* The objective of this course is to present the major ideas of social psychology in the context of the theoretical orientations from which they have emerged. The nature and role of theory in social psychology are examined. The social psychologies of various theorists are then examined in terms of their particular approaches including the Gestalt, Field, Role, Psychoanalytic and Reinforcement orientations and combinations of these. Graduate Staff

SOC 631 Population Analysis. *Preq.: Six hours SOC. 3(3-0).* Methods of describing, analyzing and presenting data on human populations: distribution, characteristics, natural increase, migration and trends in relation to resources. Graduate Staff

SOC 632 Sociology of the Family. *Preq.: Six hours SOC. 3(3-0).* Emphasis is placed on the development of an adequate sociological frame of reference for family analysis; on discovering both the uniquely cultural and common-human aspects of the family by means of cross-cultural comparisons; on historical explanations for variability in American families with special concern for the family; and on analyzing patterns of family stability and effectiveness. Graduate Staff

SOC 633 The Community. *Preq.: Six hours SOC. 3(3-0).* The community is viewed in sociological perspective as a functioning entity. A method of analysis is presented and applied to eight "dimensions," with emphasis on the unique types of understanding to be derived from measuring each dimension. Finally, the effect of change on community integration and development is analyzed. Graduate Staff

SOC 641 Statistics in Sociology. *Preq.: ST 513 or equivalent. 3(3-0).* The application of statistical methods of sociological research. Emphasis on selecting appropriate models, instruments and techniques for the more frequently encountered problems and forms of data. Graduate Staff

SOC 645 Advanced Sociological Measurement. *Preqs.: SOC 611; ST 511 or 513. 3(3-0).* Various issues concerning the measurement of social variables are examined and techniques are described. These issues and techniques include operationalism and epistemic correlation, levels of measurement, transformations, social indicators, scaling, dimensionality, validity and reliability. Existing examples and potential applications in sociological research are considered. Graduate Staff

SOC 646 Advanced Sociological Analysis. *Preqs.: SOC 611; ST 511 or 513. 3(3-0).* Advanced analysis techniques adaptable to the needs of sociological research are examined. Special attention is given to causal analysis, the analysis of change, and aggregate *versus* individual level data analyses. Sociological examples are considered. Emerging issues and techniques are given attention. Graduate Staff

SOC 650 Contemporary Sociological Theory. *Preq.: SOC 511 or equivalent. 3(3-0).* Works by major figures who represent leading schools of sociological theory in the post-World War II period are studied as primary sources. Underlying assumptions are made explicit, the structure of the theory, including propositions, are examined critically, and relationships with other theoretical perspectives are discussed. Graduate Staff

SOC 652 Comparative Societies. *Preq.: Six hours SOC. 3(3-0).* Sociological analysis of societies around the world with particular reference to North and South America. Special

emphasis is given to cultural and physical setting, population composition, levels of living, relationship of the people to the land, structure and function of the major institutions and forces making for change.
Graduate Staff

SOC 653 Theory and Development of Sociology. *Preqs.: SOC 511, CI. 3(3-0).* Detailed analysis of methodological and substantive problems in utilizing sociological theories in varied areas, and an examination of events and trends in the development of sociology.
Graduate Staff

SOC 655 Theory Construction. *Preq.: SOC 511 or equivalent. 3(3-0).* Provides students with a capability to develop theoretical frames of reference within which to devise and implement research activities. Acquaints students with the philosophical and disciplinary bases of theory, establishes the relationship between theory and research and enables objective evaluation of theoretical positions encountered in the literature.
Graduate Staff

SOC 670 Theories of Population. *Preq.: SOC 509 and/or SOC 511 or CI. 3(3-0).* This course provides an overview of population theory utilizing a combined chronological and topical approach. Major topics include: sociological analysis of ancient and medieval views of population; mercantilism and population; economic, utopian, philosophical and biological theories of population in the 18th century; Malthusian theory; and post-Malthusian theory, including biological, anthropological, mathematical, economic, political, historical and especially social and social-psychological approaches.
Graduate Staff

SOC 671 Social Demography. *Preq.: SOC 509 or 631 or equivalents. 3(3-0).* The basic purpose of this course is to develop on the part of the student an appreciation of the sociological variables capable of being used in demographic research and to provide an overview of the current substantive knowledge concerning social and demographic systems, social action systems and social aggregate systems.
Graduate Staff

SOC 690 Seminar. *Credits Arranged.* Appraisal of current literature; presentation of research papers by students; progress reports on departmental research; review of developing research methods and plans; reports from scientific meetings and conferences; other professional matters.
Graduate Staff

SOC 699 Research in Sociology. *Preq.: Consent of chairman of graduate study committee. Credits Arranged.* Planning and execution of research and preparation of manuscript under supervision of graduate committee.
Graduate Staff

Soil Science

GRADUATE FACULTY

Professor R. H. Miller, Head

Professors: S. W. Buol, D. K. Cassel, M. G. Cook, F. R. Cox, G. A. Cummings, C. B. Davey, J. W. Gilliam, W. A. Jackson, E. J. Kamprath, C. B. McCants, J. A. Phillips, C. D. Raper Jr., P. A. Sanchez, E. D. Seneca, R. J. Volk, J. B. Weber, S. B. Weed, A. G. Wollum II; *Professor (USDA):* G. R. Burns; *Extension Professor:* J. V. Baird; *Visiting Professor:* R. B. Daniels; *Professors Emeriti:* W. V. Bartholomew, R. W. Cummings, J. W. Fitts, J. F. Lutz, W. G. Woltz, W. W. Woodhouse Jr.; *Associate Professors:* L. D. King, R. E. McCollum, G. S. Miner, G. C. Naderman, J. J. Nicholaides, J. E. Shelton, R. W. Skaggs; *Associate Professor (USDA):* D. W. Israel; *Extension Associate Professor:* H. J. Kleiss; *Ad-*

junct Associate Professor: D. W. Eaddy; *Assistant Professors:* H. L. Allen Jr., A. Amoozegar-Fard, S. W. Broome, G. D. Hoyt, R. Lea, C. K. Martin, L. A. Morris, W. P. Robarge, M. V. Vepraskas; *Visiting Assistant Professors:* T. J. Smyth, M. K. Wade

The Department of Soil Science offers graduate programs leading to the Master of Science and Doctor of Philosophy degrees. These are research-oriented degrees and require a thesis/dissertation based on individual research on some aspect of the science. In addition, the Master of Agriculture and Master of Life Sciences degrees (non-thesis) may be obtained through the department.

Each M.S. and Ph.D. student will participate in one of many active research projects supervised by personnel in the department. The research may be specialized in one of the traditional sub-disciplines, *e.g.*, soil chemistry or it may integrate subject matter from related disciplines to address current societal needs, *e.g.*, waste management. Several of the projects are interdepartmental in character and, thus, a student may develop a particularly strong supportive program in one of the cooperating departments.

The department provides opportunities for students to tailor their programs for careers in research, teaching, extension or international programs. A student A student interested in one of these areas is encouraged to add this special dimension to the research emphasis required of all students. Arrangements for these opportunities are made on an individual basis with appropriate faculty.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

SSC 501 Tropical Soils: Characteristics and Management. *Preqs.: Six credits in SSC. 3(3-0) S.* Characteristics of the tropical environment. Distribution and classification of tropical soils. Soil plant relationships in the tropics. Soil management systems emphasizing shifting cultivation, flooded rice production, subsistence farming and tropical pasture management. Sanchez

SSC 511 Soil Physics. *Preqs.: SSC 200, PY 212. 4(3-3) F.* The study of soil physical properties and theory of selected instrumentation to measure them. Topics include soil solids, soil water, air and heat. Transport processes and the energy concept of soil and water are emphasized. Cassel

SSC 520 Soil and Plant Analysis. *Preqs.: PY 212; CH 315; at least three soils courses including SSC 341 or CI. 3(2-3) S.* Theory and advanced principles of the utilization of chemical instruments to aid research on the heterogeneous systems of soils and plants. Gilliam

SSC 522 Soil Chemistry. *Preqs.: SSC 200, one year of general inorganic chemistry. 3(3-0) S.* A consideration of the chemical and colloidal properties of clay and soil systems, including ion exchange and retention, soil solution reactions, solvation of clays and electrokinetic properties of clay-water systems. Weed

SSC (MB) 532 Soil Microbiology. *Preqs.: MB 401; CH 220 or CI. 4(3-3) S.* Soil as a medium for microbial growth, the relation of microbes to important mineral transformations in soil, the importance of biological equilibrium and significance of soil microbes to environmental quality. Wollum

SSC 541 Soil Fertility. *Preq.: SSC 341. 3(3-0) F.* Soil conditions affecting plant growth and the chemistry of soil and fertilizer interrelationships. Factors affecting the availability of nutrients. Methods of measuring nutrient availability. Kamprath

SSC 551 Soil Morphology, Genesis and Classification. *Preqs.: MEA 120, SSC 200, SSC 341. 3(3-0) F.* Morphology: Chemical, physical and mineralogical parameters useful in characterizing soil. Genesis: Soil-forming factors and processes. Classification: Historical development and present concepts of soil taxonomy with particular reference to worldwide distribution of great soil groups as well as discussions of logical bases of soil classification. Buol

SSC 553 Soil Mineralogy. *Preqs.: SSC 200, SSC 341, MEA 330. 3(2-3) F.* Composition, structure, classification, identification, origin, occurrence and significance of soil minerals with emphasis on primary weatherable silicates, layer silicate clays and sesquioxides. Weed

SSC 560 Advanced Soil Management. *Preqs.: SSC 200, 341. 3(3-0) Sum.* Studies of soil characteristics in the coastal plain, piedmont and mountain areas of North Carolina. Discussion of management practices that should be associated with various soils for different types of enterprises. Two overnight field trips are required. (Offered Sum. 1985 and alt. years.) Graduate Staff

SSC 590 Special Problems. *Preq.: SSC 200. Credits Arranged. F,S.* Special problems in various phases of soils. Emphasis will be placed on review of recent and current research. Graduate Staff

FOR GRADUATES ONLY

SSC (CS, HS) 614 Herbicide Behavior in Plants and Soils. *3(3-0) F.* (See crop science.)

SSC (MB) 632 Ecology and Functions of Soil Microorganisms. *Preqs.: MB 401, SSC (MB) 532 or equivalent. 3(3-0) S.* A comprehensive examination of theories and concepts relative to ecology and functions of soil microorganisms. Topics include relationships of microbes to their environments, adaptive mechanisms, microbial processes in soil organic matter formation and degradation, and function of organic matter in soil systems. Subject emphasis will be determined by class interests and by current literature. (Offered 1985 and alt. years.) Graduate Staff

SSC 651 Pedology. *Preqs.: SSC 522, 511; SSC 551 or equivalent. 3(3-0) S.* A critical study of current theories and concepts in soil genesis, morphology and classification. (Offered 1984 and alt. years.) Buol

SSC (BAE) 671 Theory of Drainage—Saturated Flow. *3(3-0) Alt. F.* (See biological and agricultural engineering.)

SSC 672 Soil Properties and Plant Development. *Preqs.: BCH 551, SSC 522 or equivalent. 3(3-0) S.* An examination of the interrelationships of soil properties and plant characteristics which regulate inorganic ion accumulation and dry matter production in higher plants. (Offered 1984 and alt. years.) Jackson

SSC (FOR) 673 Advanced Forest Soils. *3(2-3) Alt. F.* (See forestry.)

SSC (BAE) 674 Theory of Drainage—Unsaturated Flow. *3(3-0) Alt. S.* (See biological and agricultural engineering.)

SSC 690 Seminar. *Preq.: Grad. standing in SSC. 1(1-0) F.S.* A maximum of two semester hours is allowed toward the master's degree, but any number toward the doctorate. Scientific articles, progress reports in research and special problems of interest to soil scientists reviewed and discussed.
Graduate Staff

SSC 693 Colloquium in Soil Science. *Preq.: Grad. standing in SSC. Credits Arranged. F.S.* Seminar-type discussions and lectures on specialized and advanced topics in soil science.
Graduate Staff

SSC 699 Research. *Preq.: Grad. standing in SSC. Credits Arranged. F.S.* A maximum of six semester hours is allowed toward the master's degree but any number towards the doctorate.
Graduate Staff

Special Education

For information on this program, see special education under education.

Statistics

GRADUATE FACULTY

Professor D. L. Solomon, Head

Professors: B. B. Bhattacharyya, C. C. Cockerham, A. R. Gallant, T. M. Gerig—*Graduate Administrator,* F. G. Giesbrecht, H. J. Gold, M. M. Goodman, W. L. Hafley, T. Johnson, A. R. Manson, L. A. Nelson, C. H. Proctor, C. P. Quesenberry, J. O. Rawlings, D. L. Ridgeway, H. R. van der Vaart, J. L. Wasik, B. S. Weir, O. Wesler; *Adjunct Professors:* A. L. Finkner, J. T. Wakeley; *Professors Emeriti:* A. H. E. Grandage, R. J. Hader, D. W. Hayne, D. D. Mason, F. E. McVay, R. J. Monroe, J. A. Rigney, R. G. D. Steel; *Associate Professors:* D. D. Boos, D. A. Dickey, A. C. Linnerud, K. H. Pollock, T. W. Reiland, W. H. Swallow, M. Wann; *Adjunct Associate Professors:* J. R. Chromy, H. L. Crutcher, J. H. Goodnight; *Assistant Professors:* C. Brownie, E. J. Dietz, T. H. Emigh, J. F. Monahan, S. G. Pantula

The Department of Statistics offers programs leading to the Master of Science and Doctor of Philosophy degrees in both statistics and biomathematics and to the Master of Statistics and Master of Biomathematics degrees. It also offers co-major and joint Ph.D. programs with other departments including economics and business, crop science, genetics, biomathematics, operations research, forestry and computer studies. Flexible minor programs in statistics are offered at the Master's and Ph.D. levels. With a faculty of 36 representing virtually all major statistical specializations, the department is recognized as a world leader in graduate education and research in statistics. Its applied orientation sets it apart from most other departments in the country, offering training to those wishing to pursue careers as consulting statisticians in industry and government as well as to those seeking careers in research and teaching.

Research is a principal activity of the faculty and advanced graduate students. Areas of research specialization include time series, biomathematics, econometrics, quantitative genetics and ecology, experimental design and analysis, multivariate analysis, sampling, life science applications, statistical computing, parametric modeling, robust and nonparametric inference, mathematical programming, Bayesian inference, decision theory and stochastic processes.

The department provides consulting services to many other departments. This function places the department in a unique position in the University community, offering opportunities for collaboration and providing students with hands-on consulting experiences.

In addition to its ongoing program, the department houses three special groups. The Biomathematics Graduate Program, which is described under biomathematics, offers its own degrees and supports a research program. The Quantitative Genetics Research Program is an internationally respected research group of faculty, post-doctoral fellows and graduate students. The Southeastern Cooperative Fish and Game Statistics Project provides statistical consulting services to wildlife agencies in the southeast. Training and research in wildlife statistics are supported through this project.

The well-prepared applicant to the department's Master's program has good grades in a three-semester calculus sequence, a two-semester advanced calculus sequence, a semester of linear algebra and a two-semester applied statistics sequence. Some of these courses can be taken as part of the program but this may result in lengthening the stay. Admission to our Ph.D. program is granted to students who have passed the departmental Basic Comprehensive Examination at the Ph.D. level. A suitably prepared student can complete the Master's degree in two years. The Ph.D. usually requires two years beyond the Master's.

Departmental assistantships and fellowships are awarded each year on a competitive basis. Fellowships are provided through the Department's Gertrude M. Cox Fellowship Fund. Approximately 15 teaching assistantships and 15 research assistantships are also available.

Extensive library facilities are available in the area including the University's D. H. Hill Library, the Statistics departmental library, and those at Duke University and the University of North Carolina at Chapel Hill.

The department offers extensive computing support to its faculty and students. Its facilities include access to mainframe computers (IBM 3081 and 4341) via Televideo 920 and 950 series terminals located in our computing laboratory. A Tektronix 4010-1 graphics terminal and 4662A 8-pen flat-bed plotter provide excellent graphics output capabilities. Microcomputers in use in the department include the IBM-PC, SAGE IV, Radio Shack TRS-80 Model 16 and Televideo 802. A wide range of processing capabilities are available, including interactive computing via TSO, WYLBUR or CMS; higher level languages FORTRAN, PL/1, APL, PASCAL and many more; a variety of statistical packages and graphics systems such as SAS, DMDP, SPSS and IMSL.

Currently, employment opportunities are excellent for statisticians trained at all levels. The department regularly receives notification of job openings from industry, government and academic institutions. The National Science Foundation predicts a shortage of statisticians in the coming years.

SELECTED ADVANCED UNDERGRADUATE COURSES

ST 401, 402 Basic Statistical Analysis. *Preq.: (401) ST 302 or 372; (402) ST 401. 3(3-0) F,S.*

ST 421, 422 Introduction to Mathematical Statistics. *Preq.: (421) MA 202 or MA 212; (422) ST 421. 3(3-0) F,S.*

ST 493 Special Topics in Statistics. *Preq.: CI. 1-3 F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ST 505 Applied Nonparametric Statistics. *Preq.: ST 372 or ST 511. 3(3-0) S.* Statistical methods that require relatively mild assumptions about the form of the population distribution, removal, change in ratio, quadrat and line transect sampling. Emphasis on model assumptions and study design. (Offered F 1984 and alt. years.)
Dietz

ST (ZO) 506 Sampling Animal Populations. *Preq.: ST 512. 3(3-0) F.* Statistical methods applicable to sampling of wildlife populations, including capture-recapture, removal, change in ratio, quadrat and line transect sampling. Emphasis on model assumptions and study design. (Offered F 1984 and alt. years.)
Pollock

ST 507 Statistics for the Behavioral Sciences I. *3(3-0) F.* A general introduction to the use of descriptive and inferential statistics in behavioral science research. Methods for describing and summarizing data are presented, followed by procedures for estimating population parameters and testing hypotheses concerning the summarized data.
Dietz, Wasik

ST 508 Statistics for the Behavioral Sciences II. *Preq.: ST 507 or CI. 3(3-0) S.* The use of statistical design principles in behavioral science research is introduced. The use of a statistical model to represent the structure of data collected from a designed experiment or survey study is presented. Opportunities are provided for use of a computer to perform analyses of data to evaluate the proposed statistical model and to assist in post-hoc analysis procedures. Least squares principles are used to integrate the topics of multiple linear regression analysis, the analysis of variance and analysis of covariance.
Wasik

ST 511 Experimental Statistics for Biological Sciences I. *Preq.: ST 311 or grad. standing. 3(3-0) F,S.* Basic concepts of statistical models and use of samples; variation, statistical measures, distributions, tests of significance, analysis of variance and elementary experimental design, regression and correlation, chi-square.
Graduate Staff

ST 512 Experimental Statistics for Biological Sciences II. *Preq.: ST 511 or equivalent. 3(3-0) F,S.* Covariance, multiple regression, curvilinear regression, concepts of experimental design, factorial experiments, confounded factorials, individual degrees of freedom and split-plot designs.
Graduate Staff

ST 513 Experimental Statistics for Social Sciences I. *Preq.: ST 311 or grad. standing. 3(3-0) F.* Basic ideas of statistical inference; probability distributions, hypothesis testing, estimation, with emphasis on applications to sample data from experiments and surveys.
McVay

ST 514 Experimental Statistics for Social Sciences II. *Preq.: ST 513 or equivalent. 3(3-0) S.* Extension of basic statistical concepts to computer handling of data from social surveys; sample designs using clustered, stratified, systematic and multi-stage selections; analysis of variance continued; multiple, multivariate regression.
Proctor

ST 515, 516 Experimental Statistics for Engineers. *Preq.: ST 361 or grad. standing. 3(3-0) F, S.* General statistical concepts and techniques useful to research workers in engineering, textiles, wood technology, etc. Probability distributions, measurement of precision, simple and multiple regression, tests of significance, analysis of variance, enumeration data and experimental designs. Manson

ST 517 Applied Least Squares. *Preq.: ST 402 or equivalent. 3(3-0) F.* Least squares estimation and hypothesis testing procedures for linear models. Regression, analysis of variance and covariance is considered in a unified manner that requires no extensive mathematical background. Emphasis is on the use of the computer to apply these techniques to experimental (including unequal cell sizes) and survey situations. Rawlings

ST 519 Applied Multivariate Statistical Analysis. *Preq.: ST 512 or equivalent. 3(3-0) S.* An introduction to the use of multivariate statistical methods in the analysis of data collected in experiments and surveys. Topics covered will include multivariate analysis of variance, discriminant analysis, canonical correlation analysis and principal components analysis. The use of a computer to perform the multivariate statistical analysis calculations will be emphasized. Gerig, Monahan, Wasik

ST 521 Statistical Theory I. *Coreqs.: MA 425 or MA 511 and MA 405. 3(2-2) F.* Discussion of the use of statistics as illustrated by an example pointing out the need for a probabilistic framework. The probability tools for statistics: description of discrete and absolutely continuous distributions, expected values, moments, moment generating functions, transformation of random variables, marginal and conditional distributions, independence, order statistics, multivariate distributions, concept of random sample, derivation of many sampling distributions. Bhattacharyya

ST 522 Statistical Theory II. *Preq.: ST 521; Coreq.: MA 426 or MA 512. 3(2-2) S.* General framework for statistical inference. Point estimators: biased and unbiased, minimum variance unbiased, least mean square error, maximum likelihood and least squares, asymptotic properties. Interval estimators and tests of hypotheses: confidence intervals, power functions, Neyman-Pearson lemma, likelihood ratio tests, unbiasedness, efficiency and sufficiency. Bhattacharyya

ST 531 Design of Experiments. *Preq.: ST 402 or equivalent. 3(3-0) F.* Review of completely randomized, randomized complete block and Latin square designs and the basic concepts in the techniques of experimental design. Designs and analysis methods in factorial experiments, confounded factorials, response surface methodology, change-over design, split-plot experiments and incomplete block designs. Examples will be used to illustrate application and analysis of these designs. Giesbrecht

ST 532 Introduction to Survey Sampling. *Preq.: MA 214 or ST 311 or equivalent. 3(3-0) S.* Description of the principal steps in the planning and execution of sample surveys. Review of actual surveys in various fields. Basic concepts of sampling and sampling methods. Practice in evaluating and designing sample surveys. Proctor, Wasik

ST (MA) 541 Theory of Probability I. *3(3-0) F, Sum.* (See mathematics.)

ST (MA) 542 Introduction to Stochastic Processes. *Preqs.: MA 405 and MA 541 or ST 521. 3(3-0) S.* Markov chains and Markov processes, Poisson process, birth and death processes, queuing theory, renewal theory, stationary processes, Brownian motion. Bhattacharyya, Wesler

ST 552 Basic Theory of Least Squares and Variance Components. *Preqs.: MA 405, ST 521; Coreq.: ST 522. 3(2-2) S.* Theory of least squares; multiple regression; analysis of variance and covariance; experimental design models; factorial experiments; variance component models. Swallow

ST (EB) 561 Intermediate Econometrics. 3(3-0) S. (See economics and business.)

ST (BMA, MA) 571 Biomathematics I. 3(3-0) F. (See biomathematics.)

ST (BMA, MA) 572 Biomathematics II. 3(3-0) S. (See biomathematics.)

ST 581 Introduction to Nonparametric Statistics. *Preq.: ST 522.* 3(3-0) F. This course will treat both theoretical and methodological material relevant to inference problems arising when sampling is from a parent family with distribution function that is not assumed to have a particular functional form. Most of the course will be devoted to inference problems for the absolutely continuous family of distributions. (Offered F 1985 and alt. years.)

Boos

ST 583 Introduction to Statistical Decision Theory. *Preq.: ST 522.* 3(3-0) F. Zero sum two-person games and statistical inference. Bayesian methods and orthodox statistical estimation and testing; minimax decision rules; empirical Bayes procedures; Bayes sequential decision procedures. (Offered F 1984 and alt. years.)

Bhattacharyya, Monahan

ST 591 Special Problems. *Preq.: CI. 1-3 F,S,Sum.* Development of techniques for specialized cases, particularly in connection with thesis and practical consulting problems.

Graduate Staff

FOR GRADUATES ONLY

ST (MA, OR) 606 Mathematical Programming II. *Preqs.: OR (IE, MA) 505 and MA 425 or equivalent.* 3(3-0) F. This course provides an advanced mathematical treatment of the analytical and algorithmic aspects of finite dimensional nonlinear programming. It includes an examination of the structure and effectiveness of computational methods for unconstrained and constrained minimization. Special attention will be directed toward current research and recent developments in the field.

Peterson, Reiland

ST 613 Time Series Analysis I. *Preqs.: ST 522 and ST 402 or equivalent.* 3(3-0) F. Statistical analysis of realizations of covariance stationary stochastic processes with emphasis throughout on the spectrum. Applications of the theory and methods developed are discussed and illustrated with examples. Topics include autoregressive processes, moving average processes, spectral analysis; estimation of the parameters appearing in a time series generated by a linear response function and covariance stationary errors; estimation of the spectrum and its use in the analysis of the residuals from fitted models. (Offered F 1984 and alt. years.)

Dickey

ST 614 Time Series Analysis II. *Preq.: ST 613.* 3(3-0) S. Extension of the theory and methods developed in ST 613 to multiple time series and nonlinear response functions. Topics include cross-spectral density, co-spectral density, quadrature-spectral density, coherence and phase; estimation of the parameters appearing in a time series generated by a nonlinear response function and covariance stationary errors; estimation of the cross-spectral density. (Offered S 1985 and alt. years.)

Dickey

ST (MA) 617, 618 Measure Theory and Advanced Probability. *Preqs.: MA 426; ST 521 or MA 541 or equivalent.* 3(3-0) F,S. Modern measure and integration theory in abstract spaces. Probability measures, random variables; expectations. Distributions and characteristic functions. Modes of convergence. Independence, zero-one laws, laws of large numbers, three-series theorem. Central limit problem. Conditional expectations, martingales and martingale convergence theorems.

Bhattacharyya, Wesler

ST (MA) 619 Topics in Advanced Probability. *Preq.: ST (MA) 618.* 3(3-0) F. Infinitely divisible distributions and stable laws. Stationarity, ergodic theorems. Markov chains. Weak

convergence of probability measures on metric spaces, Brownian motion, invariance principles, law of the iterated logarithm. Wesler

ST 621 Statistics in Animal Science. *Preq.: ST 517 (ST 402 for statistics majors) or CI. 3(3-0)* S. Sources and magnitudes of errors in experiments with animals, experimental designs and computer methods of analysis adapted to specific types of animal research; relative efficiency of alternate designs, amount of data required for specified accuracy, student reports of selected topics. Linnerud

ST 623 Statistics in Plant Science. *Preq.: ST 512 or equivalent. 3(3-0)* F. Principles and techniques of planning, establishing and executing field and greenhouse experiments. Size, shape and orientation of plots; border effects; estimation of size of experiments for specified accuracy; subsampling plots and yields for laboratory analysis; combining data from a series of years and/or locations; rotation experiments; soil test correlation; multiple comparisons in variety trial results; selection of predictors in multiple regression; introduction to interspecies and intraspecies plant competition experiments and models. Nelson

ST (GN) 626 Statistical Concepts in Genetics. *Preq.: GN 506; Coreq.: ST 402 or equivalent. 3(3-0)* S. Migration, mutation, selection, drift, linkage, mating system and other processes that bear on rates of change in population frequencies, means and variances; magnitude and nature of genotypic and nongenotypic variability and their role in alternative procedures of plant and animal breeding; experimental and statistical approaches to the analysis of quantitative inheritance. (Offered S 1984 and alt. years.) Cockerham

ST 631 Theory of Sampling Applied to Survey Design. *Preqs.: MA 214 or equivalent; ST 402 or equivalent. 3(3-0)* F. Principles for interpretation and design of sample surveys. Estimator biases, variances and comparative costs. Simple random sample, cluster sample, ratio estimation, stratification, varying probabilities of selection. Multi-stage, systematic and double sampling. Response errors. Proctor

ST 637 Advanced Statistical Inference. *Preqs.: ST 522, ST 617. 3(3-0)* S. This course will treat the classical areas of statistical inference, estimation and hypothesis testing, at the measure-theoretical level. Emphasis will be upon treatment of these areas in depth. Quesenberry, van der Vaart

ST 645 Statistical Computing. *Preq.: ST 552. 3(3-0)* F. The intent of the course is to provide the statistician with the computational tools for statistical research and applications using digital computing machinery. Topics to be covered include random number generation and Monte Carlo methods, regression computations and application to statistical methods of optimization, sorting and Fast Fourier transform. Monahan

ST (EB) 651 Econometrics. *3(3-0)* F. (See economics and business.)

ST (EB) 652 Topics in Econometrics. *3(3-0)* S. (See economics and business.)

ST 671 Advanced Analysis of Variance and Variance Components. *Preqs.: ST 402 or equivalent, ST 552. 3(3-0)* S. Expected mean squares, exact and approximate tests of hypotheses for balanced and unbalanced data sets. Fixed, mixed and random models. Randomization theory. Estimation of variance components using regression, MINQUE and general quadratic unbiased estimation theory. Giesbrecht

ST 674 Advanced Topics in Construction and Analysis of Experimental Designs. *Preqs.: ST 402 or equivalent, ST 552. 3(3-0)* S. Construction and analysis of multifactor designs, factorials, fractional factorials, balanced incomplete block designs, Latin squares, orthogonal arrays of strength d and response surface designs. Fractionating mixed level factorials, confounding and blocking techniques, study of robustness of designs to loss of design point. Manson

ST 682 Statistical Analysis for Linear Models. *Preqs.: ST 402 or equivalent, ST 552. 3(3-0) F.* Theory and analysis of the general linear model including models with equality and inequality constraints, with possibly singular covariance structure and with multivariate responses. Canonical decompositions and optimality properties of standard methods. Applications to certain designs and growth curve analysis. Robust regression techniques. Strategic transformation of data. Gerig

ST 683 Multivariate Analysis. *Preqs.: ST 522 and ST 682. 3(3-0) S.* Survey of multivariate statistical theory. Multivariate distributions including the multinormal, Wishart, Hotelling's T^2 , Fisher-Roy-Hsu, Wilks' V and multivariate Beta distributions. Applications of maximum likelihood estimation, likelihood ratio testing and the union-intersection principle. Development of the theory of Hotelling's T^2 tests and confidence sets, discriminant analysis, canonical correlation, multivariate analysis of variance and principal components. (Offered S 1984 and alt. years.) Gerig

ST 691 Advanced Special Problems. *Preqs.: ST 402 or equivalent, ST 552. 1-3 F,S,Sum.* Any new advance in the field of statistics which can be presented in lecture series as unique opportunities arise. Graduate Staff, Visiting Professors

ST 694 Seminar. *1(1-0) F,S.* Graduate Staff

ST 699 Research. *Credits Arranged. F,S,Sum.* Graduate Staff

Textiles

GRADUATE FACULTY

Professor D. S. Hamby, Dean

Professors: D. R. Buchanan, D. M. Cates—Graduate Administrator in Textile Chemistry, J. A. Cuculo, A. H. M. El-Shiekh, P. D. Emerson, R. E. Fornes, T. W. George, R. D. Gilbert, P. L. Grady—Assistant Dean for Textile Extension, B. S. Gupta—Graduate Administrator of the Department of Textiles Materials and Management, S. P. Hersh—Acting Head of the Department of Textile Materials and Management, C. D. Livengood, P. R. Lord, R. McGregor, M. H. M. Mohamed—Assistant Dean for Academic Programs, A. B. Moss, M. H. Theil, C. Tomasino, P. A. Tucker Jr., W. K. Walsh—Associate Dean and Graduate Administrator in Fiber and Polymer Science, W. M. Whaley—Head of the Department of Textile Chemistry; Adjunct Professors: F. I. Carroll, K. A. Dellian, J. E. Hendrix, H. F. Mark, A. A. Volpe; Professors Emeriti: J. F. Bogdan, K. S. Campbell, D. W. Chaney, G. Goldfinger, J. A. Porter Jr., H. A. Rutherford, M. R. Shaw, R. W. Work; Associate Professors: R. L. Barker, S. K. Batra, G. A. Berkstresser, R. A. Donaldson, C. L. Dyer, H. S. Freeman T. H. Guion, P. B. Hudson, G. N. Mock, M. L. Robinson Jr., W. C. Stuckey Jr.; Adjunct Associate Professors: T. Murayama, D. M. Powell, P. E. Sasser, M. W. Suh; Associate Professors Emeriti: A. C. Hayes, T. G. Rochow; Assistant Professor: G. W. Smith

The School of Textiles offers programs leading to the Master of Science degree in the Departments of Textile Chemistry and Textile Materials and Management, the professional degree of Master of Textiles and the Doctor of Philosophy in fiber and

polymer science. (See fiber and polymer science for a description of the program.) The School of Textiles also participates in the Master of Science in management program in which students combine studies in the Department of Economics and Business with courses from the Department of Textile Materials and Management (see management).

Students otherwise meeting the requirements of the Graduate School and with Bachelor of Science degrees with majors in textiles, the physical sciences or engineering will normally qualify for the graduate degree programs.

The minimum requirement for a Master of Textiles degree is the satisfactory completion of 33 semester hours of advanced courses. There is no thesis or foreign language requirement. This program offers the student advanced professional training with emphasis on management, quality or manufacturing control, technology, machine design or textile design.

The programs of study for the Master of Science degree include a minimum of 30 semester hours of advanced courses, including six semester hours devoted to a thesis based on research conducted by the student. There is no foreign language requirement. The plan of course work and the research activities for the Master of Science degree are designed to prepare the student for a career in research, development or other technical phases of the textile and allied industries. Students may minor in one or more of a number of associated fields.

Programs of study may be arranged to develop a broad background in three general areas: advanced textile materials science, production and marketing management of textiles and textile chemistry. Those students interested in the first of these may emphasize areas such as fiber and yarn processing operations, mechanical and physical properties of fibers and textile structures and testing or quality control. Programs leading to the Master of Science degree in textile chemistry emphasize fiber and polymer chemistry in its own right and as a basis for dyeing and finishing treatments for textile materials. In the area of marketing and production management, the program emphasizes the applications of quantitative decision-making methods, including operations research and computer techniques, to the textile industry. Programs in this area normally terminate within the School of Textiles with a master's degree but may be structured to provide suitable backgrounds for students wishing to do further graduate work in the areas of economics and business, industrial management, industrial engineering or business administration.

Fiber and Polymer Science

A list of associated courses is given on page 161.

Textiles (General Courses)

SELECTED ADVANCED UNDERGRADUATE COURSES

T 401 Environmental Aspects of the Textile Industry. *Preq.: Sr. standing. 3(3-0) S.*

T 402 Introduction to the Theory and Practice of Fiber Formation. *Preqs.: CH 103, T 203, MA 212, PY 212. 3(3-0) S.*

T 491H Honors Seminar in Textiles. *By invitation into Honors Program in Textiles. 1(1-0) F,S.*

T 493 Industrial Internship in Textiles. *Preq.: Textile core courses. 3 F,S,Sum.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

T 500 Fiber and Polymer Microscopy. *Preqs.: MA 212, PY 212, T 203. 3(1-4) F.* The art and science of light and electron microscopy; theoretical and practical aspects of visibility, resolution and contrast. Laboratory practice in assembling, testing and using various microscopes and accessories in analyzing, describing and identifying unoriented and oriented crystalline or amorphous materials. Laboratory emphasis is on the study of fibers and polymers through transmission microscopy with polarized light. Tucker

T 506 Color Science. *Preq.: Sr. in TC or grad. standing. 3(2-2) F.* A thorough discussion of color theory with particular emphasis on color measurement. Color and color difference calculations. From the data of the basic color matching experiments, the description of a color space and its transformation into the CIE color space will be followed in detail. The basis of color difference calculations will be discussed. Color matches and color differences will be calculated based on experimental data obtained in the course. McGregor

Textile Chemistry

For a listing of graduate faculty and other information, see textiles.

SELECTED ADVANCED UNDERGRADUATE COURSES

TC 405 Chemical and Physical Evaluation of Textiles. *Preqs.: T 250, TC 320 and TC 330 or T 301. 3(2-3) F.*

TC 406 Textile Chemical Technology Laboratory. *Preqs.: TC 320, 330 and sr. standing. 2(06) S.*

TC 412 Textile Chemical Analysis II. *Preq.: T 203. 3(2-3) S.*

TC 415 Principles and Practice of Textile Printing. *Preqs.: T 301 or TC 320 or PD(TX) 272. 3(2-2) F.*

TC 441 Theory of Physico-Chemical Processes in Textiles I. *Preqs.: MA 301 or 212, PY 205 or 211. 3(2-2) F.*

TC 442 Theory of Physico-Chemical Processes in Textiles II. *Preq.: TC 441. 3(2-2) S.*

TC 451 Computers in Textile Wet Processing. *Preqs.: MA 212, PY 212, T 301. 3(3-0) S.*

TC (CH) 461 Introduction to Fiber-Forming Polymers. *Preq.: CH 223. 3(3-0) F.*

TC 490 Special Topics in Textile Chemistry. *1-6 F,S.*

TC 491 Seminar in Textile Chemistry. *Preqs.: TC 320, TC 330 and sr. standing. 1(0-2) S.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

TC 504 Fiber Formation—Theory and Practice. *Preqs.: MA 301, PY 208 or CI. 3(3-0) F.* Practical and theoretical analysis of the chemical and physical principles underlying the conventional methods of converting bulk polymer to fiber; rheology; melt, dry and wet polymer extrusion; fiber drawing; heat setting; general theory applied to unit processes. Cuculo

TC 505 Theory of Dyeing. *Preq.: CH 433 or CI. 3(3-0) S.* Mechanisms of dyeing. Application of thermodynamics to dyeing systems. Kinetics of diffusion in dyeing processes. McGregor

TC 520 Chemistry of Dyes and Color. *Preqs.: CH 221 and CH 223. 3(3-0) S.* Correlation of color and chemical constitution, synthetic routes for popular dyes of all important types; electronic mechanisms for reactive dyes; chemistry of dye interactions with light, washing and other in-use influences; economic and environmental considerations. Whaley

TC 521 Dye Synthesis Laboratory. *Preq.: TC 520. 3(0-9) F.* Laboratory work in the preparation and analysis of synthetic dyes of a large number of types. Personal instruction in techniques and processes for preparation and purification of intermediates and dyes. Whaley

TC 530 The Chemistry of Textile Auxiliaries. *Preq.: One year of organic chemistry. 3(3-0) F.* Industrially important textile chemicals used for enhancing fiber and fabric properties such as durable press, water repellency, antisoiling, flame retardancy, softness, stiffness, lubricity and other uses will be studied. Correlation of effect with structure, end-use influences, interaction with fabric and fibers, sources and synthetic routes, economic and environmental considerations will be covered. Tomasino

TC 561 Organic Chemistry of High Polymers. *Preqs.: TC (CH) 461, CH 331 or CH 431. 3(3-0) S.* Principles of step- and chain-growth polymerizations; copolymerization theory; homogeneous free radical polymerization; emulsion polymerization; Ziegler-Natta polymerization; ionic polymerization. Gilbert, Theil

TC (CH) 562 Physical Chemistry of High Polymers—Bulk Properties. *Preqs.: CH 220 or 223, CH 331 or 431. 3(3-0) F.* Molecular weight; states of aggregation and their interconversion; rubbery, glassy and crystalline states; rubber elasticity; molecular friction; diffusion and viscosity; dynamics of network response; retardation and relaxation-time spectra; thermodynamics of nucleation; kinetics of crystallization. Cates

TC (CHE) 569 Polymers, Surfactants and Colloidal Materials. *3(3-0) F.* (See chemical engineering.)

TC (CHE) 570 Radiation Chemistry and Technology of Polymeric Systems. *3(3-0) S.* (See chemical engineering.)

TC 591 Special Topics in Textile Science. *Preqs.: Sr. or grad. standing and CI. 1-4 F,S.* Intensive treatments of selected topics in textile, polymer and fiber science. Graduate Staff

FOR GRADUATES ONLY

TC 662 Physical Chemistry of High Polymers—Solution Properties. *Preqs.: CH 433, TC (CH) 562. 3(3-0) S.* Sorption and diffusion; thermodynamics of polymer solutions; phase equilibria; configurational and frictional properties; determination of molecular weight. Theil

TC (CHE) 669 Diffusion in Polymers. *2(2-0) S.* (See chemical engineering.)

TC (CHE) 671 Special Topics in Polymer Science. *1-3 F.* (See chemical engineering.)

TC (TX) 691 Special Topics in Fiber Science. *1-3 S.* (See textile materials and management.)

TC 698 Seminar for Textile Chemistry. *1(1-0) F,S.* Discussion of scientific articles and presentations; review and discussion of student papers and research problems.

Graduate Staff

TC 699 Textile Research for Textile Chemistry. *Credits Arranged.* Individual research in the field of textile chemistry.

Graduate Staff

Textile Materials and Management

For a listing of graduate faculty and other information, see textiles.

SELECTED ADVANCED UNDERGRADUATE COURSES

TX 405 Contemporary Nonwoven Textiles. *Preqs.: TX 305, sr. standing and CI. 3(1-4) S.*

TX 420 Modern Developments in Yarn Manufacturing. *Preq.: Sr. standing. 3(3-0) S.*

TX 425 Textured Yarn Production and Properties. *Preqs.: T 211, T 220, PY 211 (205); Coreq.: PY 212 (208). 3(2-2) F.*

TX 431 Fabric Performance Testing. *Preqs.: TX 330, sr. standing. 3(2-2) F.*

TX 441 Knitwear and Hosiery Manufacture. *Preq.: TX 370. 3(2-2) F.*

TX 442 Advanced Knitted Fabric Design. *Preq.: TX 370. 3(2-2) S.*

TX 443 Analysis of Knitting Systems and Fabric Properties. *Preq.: TX 341. 3(3-0) F.*

TX 449 Warp Knitting Systems. *Preq.: TX 370. 3(2-2) S.*

TX 450 Advanced Weaving. *Preq.: TX 351. 3(2-2) F.*

TX 451 Advanced Woven Fabric Design. *Preq.: TX 370. 3(2-2) Alt. F.*

TX 460 Physical Properties of Textile Fibers. *Preqs.: MA 212, PY 212. 3(3-0) F,S.*

TX 461 Mechanical Properties of Fibrous Structures. *Preqs.: MA 301, TX 460. 3(3-0) S.*

TX (PD) 471 Textile Design I. *Preqs.: TX (PD) 271, 272. 3(2-2) S.*

TX (PD) 472 Textile Design II/Internship. *Preq.: PD (TX) 471. 3 Sum.*

TX (PD) 473 Textile Design III. *Preq.: PD (TX) 471. 3(2-2) F.*

TX 480 Textile Production and Cost Control. *Preqs.: TX 380, EB 301, ACC 265 or 260, sr. standing. 3(3-0) F,S.*

TX (EB) 482 Textile Marketing Management. *Preqs.: EB 313, EB 301, TX 380. 3(2-2) F,S.*

TX 484 Management Decision Making for the Textile Firm. *Preqs.: TX 480, EB 302; Coreq.: TX 482. 3(3-0) F,S.*

TX 487 Textile Labor Management. *Preq.: Sr. standing. 3(3-0) F,S.*

TX 490 Development Project in Textile Technology. *Preqs.: Sr. standing and 2.75 GPA. 2-3 F,S,Sum.*

TX 491 Special Topics in Textiles. *Preq.: Sr. standing. 1-3 F,S.*

TX 495 Senior Seminar in Textile Materials and Management. *Preqs.: Sr. standing and CI. 1(1-0) F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

TX 505 Textile Instrumentation and Control Systems. *Preqs.: MA 301, PY 212 and one course in computer science. 3(3-0) F.* The theory and application of instruments and control systems used in modern textile plants. Basic instruments and computer systems are described along with their use in process control, production control, research and development. Grady

TX 520 Yarn Processing Dynamics. *Preqs.: MA 301 and CI or grad. standing. 3(2-2) F.* Theoretical analysis of the dynamics and machine-fiber interactions of such functions as opening, cleaning, carding actions, fiber attenuation, ring spinning, open-end spinning, texturing and winding. The role of fiber placement, cohesion and lubrication on yarn processing and properties. Laboratory experiments are designed to verify the analysis discussed in the lectures. El-Shiekh

TX 530 Textile Quality Control. *Preq.: TX 330 or CI. 3(3-0) S.* Quality control systems for textile operations with emphasis on sampling plans for attributes and variables and on interpretation of data as related to identifying sources of product variability. Stuckey

TX 541 Theory and Practice of Knitted Fabric Production and Control. *Preqs.: TX 370 and CI. 3(3-0) F.* The technology and control systems for manufacturing simple and complex knitted fabrics; control and monitoring of yarn feeding systems; influence of yarn, machine, finishing and fabric structure on the fabric aesthetics, physical and mechanical properties; optimization of fabric properties and machine productivity, including costing; problems of jacquard fabric processing and control. Graduate Staff

TX 549 Warp Knit Engineering and Structural Design. *Preq.: TX 449. 3(3-0) S.* Engineering analysis of tricot and raschel machinery. Design of yarn let-off and fabric take-up mechanisms. Studies of fabric production techniques and quality control systems. Theory of production optimization and the properties of fabrics. Complex geometrical loop models and their application. Graduate Staff

TX 555 Production Mechanics and Properties of Woven Fabrics. *Preqs.: MA 301 and CI or grad. standing. 3(2-2) S.* The interrelations between the mechanics of production and mechanical properties of woven fabrics; unit operations required to prepare yarns for weaving and the mechanisms employed in weaving; fabric structure, geometry and mechanical properties; designing for specific fabric properties. Mohamed

TX 561 Mechanical and Rheological Properties of Fibrous Material. *Preq.: MA 301. 3(2-2) S.* In-depth study of the stress-strain, bending, torsional, dynamic and rheological behavior of natural and man-made fibers. Theoretical relations and advanced techniques are presented and discussed. Fornes, Gupta

TX 562 Physical Properties of Fiber Forming Polymers, Fibers and Fibrous Structures. *Preqs.: MA 301, PY 208. 3(3-0) F.* Experimental results and theoretical considerations of the physical properties of fibers and fiber forming polymers will be discussed. This will include electrical, thermal, optical, frictional and moisture properties of these materials. The influence of chemical and molecular fine structure on these properties will be discussed.
Fornes, Gupta

TX 563 Characterization of Structure of Fiber Forming Polymers. *Preqs.: MA 301, PY 208. 3(3-0) F.* Theories, experimental evidence and characterization methods of the molecular fine structure of fiber forming polymers in the solid state will be discussed. Characterization methods will include X-ray diffraction, microscopy, infrared, thermal and magnetic resonance. An introduction to nucleation theory of polymer systems will be presented.
Fornes, Gupta

TX (EB) 585 Market Research in Textiles. *Preqs.: MA 405, ST 421. 3(3-0) S.* A study and analysis of the quantitative methods employed in market research in the textile industry. The function of market research and its proper orientation to management and decision making.
Dyer

TX 590 Special Projects in Textiles. *Preqs.: Sr. standing or grad. standing, CI. 2-3 F,S,Sum.* Special studies in either the major or minor field of the advanced undergraduate or graduate student. These studies will include current problems of the industry, independent investigations, seminars and technical presentations, both oral and written.
Graduate Staff

TX 591 Special Topics. *Preq.: CI. 1-4 F,S.* An intensive treatment of selected topics involving textile technology.
Graduate Staff

TX 598 Textile Technology Seminar. *Preqs.: Sr. standing, CI. 2(2-0) S.* Lecture and discussion of current topics relating to the textile industry.
Graduate Staff

FOR GRADUATES ONLY

TX 603 Group Research in Textiles. *Preqs.: TX 520 and TX 555 or TX 541. 3(2-3) F.* Group research under supervision in which each student will execute a portion of the research and will report to the whole group. Each student will be required to write a report on the whole project. There will be formal lectures on methodology, interpretation and application of research.
Lord

TX 621 Advanced Textile Testing. *Preqs.: TX 530; ST 421 or CI. 3(2-2) S.* Design of textile laboratories required for specific needs; experimental design and performance of tests; analysis of data relating to industrial problems; specialized physical tests; interlaboratory correlations; development of standardized test methods.
Dyer, Stuckey

TX 631 Synthetic Fibers. *Preq.: TX 425 or equivalent. 2(1-2) F,S,Sum.* Lectures and projects on advanced problems associated with the properties and processing of man-made continuous filament and staple fiber yarns.
Hersh

TX 640 Physical and Mechanical Properties of Knitted Fabric. *Preq.: TX 541. 3(3-0) Alt. S.* Seminar discussions of research literature on studies of the physical and mechanical properties of knitted fabrics.
Graduate Staff

TX 651, 652 Fabric Development and Construction. *Preq.: Grad. standing. 3(1-4) F,S.* Application of advanced technology to the development and construction of woven fabrics.
Graduate Staff

TX 663 Mechanics of Twisted Structures. *Preq.: TX 561 or equivalent. 3(3-0) F.* Study of the basic mechanics of fibrous assemblies. Geometry and mechanics of twisted structures (yarns, cords, braids, etc.) and the translation of fiber properties into structural behavior.
Batra, El-Shiekh

TX 664 Mechanics of Fabric Structures. *Preq.: TX 561 or equivalent. 3(3-0) S.* Analysis of the geometry and behavior of woven, knitted and nonwoven fabrics under various stress conditions and end use applications.
Batra, El-Shiekh

TX 680 Special Projects in Textile Management. *Preq.: TX (EB) 585. 1-3 F,S,Sum.* Special studies in textile management covering current problems of the industry, independent investigations, seminars and technical presentations, both oral and written.
Graduate Staff

TX 686 Advanced Textile Labor Management Seminar. *Preq.: TX 586. 3(3-0) F,S,A.* A study of advanced labor management problems in the textile industry, with particular emphasis directed toward the application of the Occupational Safety and Health Act.
Powell

TX (TC) 691 Special Topics in Fiber Science. *Preq.: CI. 1-3 S.* The study of selected topics of particular interest in various advanced phases of fiber science.
Graduate Staff

TX 697 Independent Study in Textiles. *3(3-0) F,S,Sum.* Problems of specific interest in textiles will be assigned for study and investigation. The preparation of a report for publication will be required. Three hours maximum credit will be allowed toward Master of Textiles degree. No credit is allowed toward Master of Science in Textiles degree. Graduate Staff

TX 698 Seminar. *1(1-0) F,S.* Discussion of scientific articles of interest to the textile industry; review and discussion of student papers and research problems. Graduate Staff

TX 699 Textile Thesis or Dissertation Research. *Credits Arranged. F,S,Sum.* Problems of specific interest to the textile industry will be assigned for study and investigation. The use of experimental methods will be emphasized. Attention will be given to the preparation of reports for publication. The master's thesis may be based upon the data obtained.
Graduate Staff

Toxicology

GRADUATE FACULTY

Professor E. Hodgson, Coordinator

Professors: A. L. Aronson, G. T. Barthalmus, W. C. Dauterman, W. E. Donaldson, D. S. Grosch, F. E. Guthrie, P. B. Hamilton, R. J. Kuhr, A. R. Main, J. J. Perry, T. J. Sheets; Professors (USDA): W. W. Heck, D. E. Moreland; Adjunct Professors: M. W. Andrews, J. R. Fouts, R. A. Neal; Professors Emeriti: D. W. Hayne, R. J. Monroe; Associate Professor: H. M. Hassan; Adjunct Associate Professors: J. R. Bend, N. Chernoff, T. E. Eling, H. B. Matthews Jr., R. M. Philpot; Assistant Professor: J. E. Riviere

Graduate study under the direction of the toxicology faculty may lead to the Master of Toxicology, Master of Science and the Doctor of Philosophy degrees. The

toxicology faculty is an interdisciplinary group drawn from the following areas: biochemistry, botany, crop science, food science, genetics, entomology, microbiology, poultry science, statistics, veterinary medicine and zoology. The student will be associated with one of the above programs and conduct his research in the laboratories of his chairman or co-chairman.

The degree program is cooperative with the University of North Carolina at Chapel Hill and students may take courses at either university as well as selected courses at Duke University. A core of 6 courses taught from offerings of these three universities is a minimal requirement for the Ph.D. degree. Students are expected to take additional courses necessary for a strong background in toxicology. Minors may be chosen from a wide range of programs including biochemistry, botany, entomology, epidemiology, genetics, microbiology, nutrition, pharmacology, physiology, statistics and zoology.

The program is also closely associated with major research organizations in the nearby Research Triangle Park, including the National Institute of Environmental Health Sciences, Environmental Protection Agency, Chemical Industry Institute of Toxicology and Burroughs Wellcome Foundation. These laboratories, plus the universities, offer an unusual range of research projects and facilities.

Prerequisites for admission include a strong background in biology and physical sciences. The Aptitude Test of the Graduate Record Examination is required and the Advanced Test in biology or chemistry is desirable.

Financial assistance for qualified students in the form of traineeships, fellowships and research assistantships is available through participating departments. Prospective students may obtain further information by writing to any of the graduate faculty listed above or to the Coordinator, Toxicology Program, P. O. Box 5215, N. C. State University, Raleigh, N. C. 27650.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

TOX 510 Biochemical Toxicology. *Preqs.: Biochemistry, sr. standing. 3(3-0) F.* Emphasis is placed on the molecular events that occur during the toxic action of xenobiotics, including penetration phenomena, mechanisms involved in detoxication, and the mechanisms of action at the target site.

TOX 515 Environmental Toxicology. *Preq.: Two years of biology. 3(3-0) S.* The nature, distribution and significance of microchemical contamination will be evaluated. Emphasis will be placed on current, relevant problems.

TOX 590 Special Problems in Toxicology. *Preq.: Grad. standing. 1-3.*

FOR GRADUATES ONLY

TOX 690 Toxicology Seminar. *Preq.: Grad. standing. 1(1-0) S.*

TOX 699 Research. *Preq.: Grad. standing. Credits Arranged. F,S.* Original research in connection with thesis problem in toxicology.

COURSES FROM ASSOCIATED DEPARTMENTS

BCH 652 Biochemical Research Techniques

CH 428 Qualitative Organic Chemistry

ENT 622 Insect Toxicology
 GN (ZO) 532 Biological Effects of Radiations
 ZO 614 Advanced Cell Biology

SELECTED COURSES AT UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

PHARM 216 Introductory Pharmacology
 EPID 162 Epidemiology
 BIOSTAT 140 Evaluation of Toxicological Data (Special Section)

SELECTED COURSE AT DUKE UNIVERSITY

PATH 382 Toxicological Pathology

Urban Design

For a listing of graduate faculty and departmental information, see architecture.

Veterinary Medical Sciences

GRADUATE FACULTY

Professor C. E. Stevens, Coordinator

Professors: W. M. Adams, R. A. Argenzio, A. L. Aronson, H. J. Barnes, P. J. Bentley, H. A. Berkhoff, C. W. Betts, T. T. Brown Jr., P. B. Carter, L. Coggins, S. W. Crane, T. M. Curtin, R. C. Dillman, B. D. Harrington, D. R. Howard, C. W. McPherson, D. J. Moncol, W. D. Oxender, M. C. Roberts, D. G. Simmons, J. E. Smallwood, C.-S. Teng, D. E. Thrall; *Adjunct Professor:* F. Welsch; *Professor Emeritus:* E. G. Batte; *Associate Professors:* E. B. Breitschwerdt, E. V. DeBuysscher, R. B. Ford, B. A. Gilroy, B. Hammerberg, M. S. Hand, H. D. Hilley, J. N. Kornegay, D. C. Kradel; *Adjunct Associate Professors:* T. E. Eling, R. L. Peiffer Jr.; *Assistant Professors:* A. Ansari, L. M. Ballas, K. F. Bowman, C. F. Brownie, S. E. Bunch, G. D. Dial, L. N. Fleisher, C. K. Henrikson, L. C. Hudson, E. Hunt, D. J. Kunze, T. O. Manning, P. A. Noden, E. J. Noga, N. C. Olson, J. E. Riviere, C. L. Robinette, B. E. Straw, L. P. Tate Jr., S. L. Tonkonogy, S. J. Updike, S. D. Van Camp, M. D. Whitacre; *Visiting Assistant Professor:* M. C. McGahan; *Research Associate:* J. M. Whitsett

ASSOCIATE MEMBERS OF THE SCHOOL

Professor: R. F. Behlow; *Extension Professor:* J. R. Harris

Graduate study under the direction of the veterinary medical faculty may lead to the Master of Science and the Doctor of Philosophy degrees. The veterinary medical faculty is a multidisciplinary group drawn from the departments of the

School of Veterinary Medicine: Anatomy, Physiological Sciences and Radiology; Microbiology, Pathology and Parasitology; Companion Animal and Special Species; and Food Animal and Equine Medicine. Students will be associated with members from the above departments and conduct their research in the laboratory of their committee chairman or co-chairman.

The program provides training in basic and applied veterinary medical research to qualified students with a baccalaureate, D.V.M. or equivalent degree. Major areas of concentration include morphology, pharmacology, pathology and veterinary microbiology. Minors may be chosen from a wide range of programs including animal science, biochemistry, genetics, nutrition, poultry science, physiology, statistics, toxicology and zoology.

Prerequisites for admission include a strong background in biological science. Verbal and quantitative tests of the Graduate Record Examination are required.

Financial assistance for qualified students in the form of graduate assistantships is available through the School of Veterinary Medicine and participating faculty. Prospective students may obtain further information by writing to one of the graduate faculty listed above or to the Coordinator, Veterinary Medical Sciences Program, School of Veterinary Medicine, North Carolina State University, 4700 Hillsborough Street, Raleigh, North Carolina, 27606.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

VMS 530 Veterinary Histology. *Preqs.: BCH 451 and CI. 3(2-4) Alt. F.* The structure of cells, tissues and organs of domestic animals is studied using light microscopy.

Henrikson

VMS 531 Mammalian Neuroanatomy. *Preqs.: VMA 811 or 812 or ZO 323 and grad. standing or CI. 3(2-2) Alt. F.* The course provides detailed information about the structure of the nervous system of nonprimate animals. Emphasis is on the dog and cat but other domestic and laboratory mammals are studied. Overviews of embryology, neurohistology and experimental techniques are included.

Hudson

VMS 540 Research Animal Care and Use. *Preq.: ZO 201 or equivalent. 3(2-3) Alt. S.* The principles of the selection, care and use of animals in laboratory teaching and investigation are presented. Topics covered include the ethics of animal experimentation, selection of animal models, biology and care of laboratory animals, techniques of administration of substances and obtaining of specimens, producing surgical alterations and common laboratory animal health problems.

McCormick, McPherson

VMS 541 Laboratory Animal Diseases. *Preqs.: MB 401, VMS 540, ZO 345 and grad. standing or CI. 3(2-3) Alt. S.* The diseases of common laboratory animals are studied by discussing their etiology, epizootiology, pathogenesis and clinical signs. The diagnosis of laboratory animal diseases by clinical examination of animals and post-mortem evaluation of gross and microscopic pathologic changes within animal tissues are emphasized. Procedures for disease prevention, treatment and control are also reviewed.

McPherson, Wright

VMS 550 Veterinary Medical Virology I. *Preqs.: BCH 451, MB 401 and grad. standing. 2(2-0) S.* Basic principles of animal virology and the relationship of viruses to diseases in domestic animals are discussed.

Fuller, Simmons

VMS 551 Pathogenic Bacteriology and Mycology. *Preqs.: MB 411, grad. standing and CI. 3(2-2) F.* The lecture course covers the pathogenic bacteria and fungi important in medicine. Lectures are supplemented by laboratory exercises that provide students the opportunity to learn basic characteristics of these microorganisms and how they are isolated, cultivated and identified.
Berkhoff, Carter

VMS 552 Diagnostic Bacteriology and Mycology. *Preqs.: Grad. standing, VMM 814 or VMS 551 and CI. 3(1-8) F,S.* Principles of specimen collection, selection and use of media, culture processing and identification of bacteria and fungi important in animal disease are presented.
Berkhoff

VMS 553 Veterinary Immunology. *Preqs.: MB 501C and grad. standing. 2(2-0) F.* Basic and clinical immunology is presented. The role of the immune system in disease prevention, inflammation and autoimmune diseases is discussed.
DeBuysscher, Tonkonogy

VMS 560 Introductory Pharmacology. *Preqs.: BCH 451, grad. standing or CI. 5(4-1) F.* The action of drugs in animals and man including basic principles of drug disposition and pharmacokinetics is discussed. Modification of physiological processes by drugs influencing coordination by the nervous, endocrine and circulatory system is described.
Bentley, Fleisher, Riviere

VMS 561 Instrumentation in Pharmacological Research. *Preqs.: BCH 452B or CH 315 and grad. standing or CI. 2(1-4) F.* The theory and applications of modern scientific instrumentation to the analysis of tissues, body fluids and drugs in pharmacological research are described. Appropriate aspects of the pharmacological use of spectroscopy, microscopy, chromatography, electrophoresis, radioisotope usage and centrifugation are discussed.
Graduate Staff

VMS 562 Systemic Pharmacology and Toxicology. *Preq.: VMS 560 or equivalent. 3(3-0) Alt. S.* Drug and toxicant action at the organ systems level are discussed in terms of underlying physiological mechanisms and responses. Emphasis is placed on the kidney and liver with additional consideration given to the respiratory, reproductive, gastrointestinal, hematologic and immune systems. Methods for assessing function of these systems are presented.
Riviere, Graduate Staff

VMS 563 Systemic Pharmacology and Toxicology Laboratory. *Preqs.: VMS 560, VMS 562 and grad. standing. 1(0-4) Alt. F.* A series of laboratory exercises are given which are designed to complement the lecture course in Introductory Pharmacology (VMS 560) and Systemic Pharmacology and Toxicology (VMS 562).
Bentley, Riviere, Graduate Staff

VMS 590 Special Topics in Veterinary Medical Sciences. *Preq.: Sr. or grad. standing. 1-3 F,S,Sum.* A course designed to present new or special subject matter within the scope of pathology, veterinary microbiology, morphology or pharmacology. The studies may include independent investigations, seminars and/or formal lectures.
Graduate Staff

FOR GRADUATES ONLY

VMS 630 Cell Structure. *Preqs.: BCH 451 and VMS 530 or VMA 812 and VMA 822 and CI. 3(2-3) Alt. F.* The internal components and surface morphologies of the major cell types are studied by analyzing and interpreting photographs taken with the transmission and scanning electron microscopes. Structure-function relationships are stressed. (Techniques of electron microscopy are not taught and electron microscopes are not used in this course.)
Henrikson

VMS 631 Applied Veterinary Anatomy I. *Preqs.: DVM or equivalent and CI. 4(2-8) Alt. F.* This course provides the graduate veterinarian with detailed anatomic information relevant to surgical and medical problems in domestic carnivores. It is designed for graduate veterinarians in pursuit of advanced training in the areas of anatomy, physiology, surgery, radiology and pathology. Smallwood

VMS 640 Cellular and Subcellular Pathology. *Preqs.: VMS 630 and CI. 2(2-0) Alt. S.* Ultrastructural and biochemical changes occurring in cell injury are studied by the evaluation and interpretation of electron and scanning photomicrographs. Brown, Graduate Staff

VMS 650 Bacterial Pathogenic Mechanisms. *Preqs.: MB 501, VMS 552 or VMM 814. 2(2-0) Alt. S.* Principles of pathogenesis and host-response in bacterial infections of animals are discussed. Berkhoff, Carter

VMS 651 Veterinary Medical Virology II. *Preq.: VMM 824 or VMS 550 or CI. 3(2-4) Alt. F.* Principles of animal viral pathogenesis and host-response to viral infection are presented. The biology of selected viral groups including oncogenic viruses and persistent viruses are discussed. Common laboratory techniques used in virology are stressed. Coggins, Fuller, Simmons

VMS 660 Advanced Pharmacology. *Preqs.: VMS 560 or equivalent and CI. 2(2-0) Alt. S.* An in-depth study of current topics in pharmacology. Subjects include but are not limited to: the actions of drugs on ion permeability, prostaglandins, receptors, pharmacologically active peptides, toxicity of heavy metals and anti-fertility drugs. Graduate Staff

VMS 661 Pharmacokinetics. *Preqs.: VMS 560 or equivalent, working knowledge of calculus and CI. 3(3-0) Alt. F.* A course on mathematical models to describe the disposition of drugs and toxic chemicals in the animal body. Areas covered include classic compartmental and nonlinear models as well as physiological approaches. The application of these techniques to toxicologic studies is discussed. Riviere

VMS 690A Special Topics in Veterinary Microbiology. *Preq.: Grad. standing. 1-3 F,S.* Specific topics of study are assigned in various laboratories involved in veterinary microbiology investigation. Students conduct in-depth studies of assigned projects. Graduate Staff

VMS 690B Special Topics in Pathology. *Preqs.: Those holding DVM degree and CI. 1-4 F,S,Sum.* Students perform necropsies, microscopically evaluate tissue changes and prepare written reports of findings. Students conduct in-depth studies of each assigned case. Brown, Graduate Pathology Staff

VMS 690C Special Topics in Laboratory Pharmacology. *Preqs.: Grad. standing and CI. 1-3 F,S,Sum.* The course involves practical participation in the normal research activities of different laboratories working in pharmacological research. Students pursue a semi-independent project. Graduate Staff

VMS 694A Seminar in Necropsy Pathology. *Preqs.: Those holding the DVM or equivalent degree and CI. 1(1-0) F,S,Sum.* Description and interpretation of gross changes in tissues from diseased domestic animals. Students attend daily (M-F) 15 to 30 minute review of necropsy lesions presented by a member of the graduate staff. Brown, Graduate Pathology Staff

VMS 694B Seminar in Surgical Pathology. *Preqs.: Those holding the DVM or equivalent degree and CI. 1(1-0) F,S,Sum.* Description and interpretation of microscopic changes in tissues from diseased domestic and laboratory animals. Students attend and participate in a one-hour weekly seminar where microscopic lesions are described, interpreted and discussed. Brown, Graduate Pathology Staff

VMS 695A Seminar in Veterinary Microbiology. *Preq.: Grad. standing. 1(1-0) F.S.* Presentation of ongoing research and current topics in microbiology. Graduate Staff

VMS 696A Seminar in Pharmacology. *Preqs.: Grad. standing and Cl. 1(1-0) S.* Presentations and discussions of pharmacological topics of current interest and importance are made. Graduate Staff in Pharmacology

VMS 699 Research in Veterinary Medical Sciences. *Preq.: Grad. standing. 1-3 F,S,Sum.* Original research in connection with thesis or dissertation problems in veterinary medical sciences. Graduate Staff

Water Resources

(An interdepartmental, intercampus graduate program)

WATER RESOURCES COMMITTEE—RALEIGH CAMPUS

Dr. E. H. Wiser (Biological and Agricultural Engineering), *Chairman*

Dr. W. J. Block (Political Science and Public Administration), Dr. J. W. Gilliam (Soil Science), Dr. J. D. Gregory (Forestry), Dr. D. W. Hayne (Statistics), Dr. M. T. Huish (Zoology), Dr. V. A. Jones (Food Science), Dr. D. B. Marsland (Chemical Engineering), Dr. Gary N. Mock (Textile Chemistry), Dr. H. H. Neunzig (Entomology), Dr. J. A. Seagraves (Economics and Business), Dr. E. D. Seneca (Botany), Dr. T. J. Sheets (Pesticide Residue Research Laboratory), Prof. C. Smallwood (Civil Engineering), Dr. C. W. Welby (Marine, Earth and Atmospheric Sciences), Prof. R. R. Wilkinson (Landscape Architecture)

Water resources management is a major issue throughout the country and national policy supports strong water resources programs at all levels of government. These are multidisciplinary and require understanding of the complex effects of conservation and development. They require well-trained specialists in engineering and the physical, biological and social sciences who also possess a sound grasp of overall objectives and a full appreciation of the respective roles of the participating disciplines.

Water resources is generally considered to be an area of specialization and not a discipline. Graduate education provides an opportunity for broad exposure to water-related subjects along with intensive study in the major disciplines. Students are encouraged to reach beyond their own departments for courses to extend their range of understanding and to participate in water resources courses and seminars designed to develop interdisciplinary communication and a basis for future working relationships.

A large number of courses related to water resources conservation, development and management are currently offered on the North Carolina State University and University of North Carolina at Chapel Hill campuses. In order to capitalize on the combined educational resources of both campuses and to offer them in an organized way to graduate students seeking interdisciplinary education in this field, an intercampus graduate minor in water resources was established.

The program offers a strong graduate minor in water resources, with the major in any of the basic disciplines contributing to water resources planning, conservation, development and management. The graduate courses currently offered on both campuses have been separated into the following general areas: water law and institutions, planning of water resources and related systems, municipal and industrial water management, agricultural and forest water management, aquatic biology and ecology, hydrology and hydrogeology.

Graduate students majoring in any discipline closely allied with one of the designated water resource areas will be qualified for admission to the program. They will be expected to select their water resources minor courses from one or more areas outside their major. The cohesive elements in the graduate program will be two interdisciplinary core courses including a water resources seminar and a course in water resources planning or water resources economics.

The minimal course requirements for a graduate minor in water resources are: *Master's Degree*—The two core courses in water resources plus two courses in water resource areas outside the major discipline approved by the student's advisory committee; *Ph.D. Degree*—The two core courses in water resources plus five other courses in water resource areas outside the major discipline approved by the student's advisory committee. The complete listing of courses available under this program follows.

WATER RESOURCES CORE COURSES

<i>*Campus</i>	<i>Course</i>	<i>Title</i>
R	CE 591 or	Civil Engineering Seminar. (Water Resources Seminar)
CH	ENVR 183	Water Resources Seminar.
R	EB 515 or	Environmental and Resource Policy.
CH	PLAN 234 (ENVR 284)	Water Resources Planning and Policy Analyses.

LAW AND INSTITUTIONS OF WATER RESOURCES

R	PA 511	Public Administration.
R	PA 516	Public Policy Analysis.
R	PA 520	Environmental Policy.
R	PA 613	Government and Planning.
R	PA 612	The Budgetary Process.
CH	ENVR 283 (PLAN 233)**	Natural Resource Law and Policy.
CH	PLAN 230	Planning Law.
CH	POLI 101***	Public Administration.
CH	POLI 181	National Policy and Administration.
CH	POLI 209	Planning and Government.
CH	POLI 213	Public Administration and Policy Making.
CH	POLI 214	Budgeting and Financial Management.
CH	POLI 238	Intergovernmental Relations.

PLANNING OF WATER RESOURCES AND RELATED SYSTEMS

R	CE 575**	Civil Engineering Systems.
R	EB 401	Economic Analysis for Nonmajors.
R	EB 435	Urban Economics.

<i>*Campus</i>	<i>Course</i>	<i>Title</i>
R	EB 436	Environmental Economics.
R	EB 490	Senior Seminar in Economics.
CH	ENVR 215	Environmental Issues and Assessment.
CH	ENVR 217**	Systems Analysis in Environmental Planning.
CH	ENVR 277	Engineering Project Design.
CH	ENVR 278	Development of a Water Project.
CH	GEOG 156	Geography of Natural Resources.
CH	PLAN 219	Environmental Systems Analysis.
CH	PLAN 232 (ENVR 282)**	Public Investment Theory and Techniques.
CH	PLAN 241	Environmental Planning.

MUNICIPAL AND INDUSTRIAL WATER MANAGEMENT

R	BAE (CE) 578	Agricultural Waste Management.
R	CE 484	Water Resources Engineering II.
R	CE 486	Sanitary Engineering Measurements of Water Quality.
R	CE (BAE, MB) 570	Sanitary Microbiology.
R	CE 571	Theory of Water and Waste Treatment.
R	CE 572	Design of Water and Wastewater Facilities.
R	CE 573	Unit Operations and Processes in Waste Treatment.
R	CE (NE) 574	Environmental Consequences of Nuclear Power.
R	CE 672	Advanced Water and Waste Treatment: Principles and Design.
R	CE 673	Industrial Water Supply and Waste Disposal.
R	CE 674	Stream Sanitation.
R	FS 690	Seminar in Food Science.
R	WPS 525	Pollution Abatement in Forest Products Industries.
CH	ENVR 122	Water Chemistry.
CH	ENVR 134**	Environmental Microbiology.
CH	ENVR 171**	Principles of Water Quality Management.
CH	ENVR 172	Workshop in Water Quality Management.
CH	ENVR 174	Water and Waste Treatment Processes.
CH	ENVR 176	Hydraulics and Hydrology.
CH	ENVR 223	Trace Analysis.
CH	ENVR 271	Engineering Models for Aquatic Systems.
CH	ENVR 272**	Technology of Engineered Water Systems.
CH	ENVR 273	Water and Wastewater Treatment Plant Design.
CH	ENVR 276	Industrial Water Quality Management.

AGRICULTURAL AND FOREST WATER MANAGEMENT

R	BAE (SSC) 321****	Water Management.
R	FOR 401	Forest Hydrology and Watershed Management
R	BAE 471	Soil and Water Engineering.
R	FOR 303	Silvics and Forest Ecology
R	FOR 472	Renewable Resource Policy and Management
R	FOR 692	Advanced Forest Management Problems.
R	SSC 461	Soil Physical Properties and Plant Growth.
R	SSC 511	Soil Physics.

<i>*Campus</i>	<i>Course</i>	<i>Title</i>
AQUATIC BIOLOGY AND ECOLOGY		
R	BO (ZO) 560**	Principles of Ecology.
R	BO (MB) 574	Phycology.
R	BO 662	Applied Coastal Ecology.
R	MEA (ZO) 520	Principles of Biological Oceanography
R	MEA 693	Advanced Special Topics. (Estuarine Ecology)
R	ZO 420	Fishery Science.
R	ZO 592B	Topical Problems—Aquaculture.
R	ZO 592C	Topical Problems—Underwater Photography.
R	ZO 619	Advanced Limnology.
R	ZO 621	Fishery Science.
CH	BOTN 114	Algae.
CH	BOTN 216	Marine Algae.
CH	ENVR 123	Organic Materials in Natural Waters.
CH	ENVR 128 (MSCS 105)	Chemical Oceanography.
CH	ENVR 132**	Limnology and Water Pollution.
CH	ENVR 137	Ecology of Wetlands.
CH	ENVR 224	Chemical Models of Aquatic Systems.
CH	ENVR 231	Limnological Methods.
CH	ENVR 233	Microbial Ecology.
CH	ENVR 235	Ecology of Phytoplankton.
CH	ZOOL 102	Ecology.
CH	ZOOL 109**	Introduction to Hydrobiology.
CH	ZOOL 126 (MSCS 101)**	Oceanography.
CH	ZOOL 140S (MSCS 140S)**	Biological Oceanography.
CH	ZOOL 141S	Special Problems in Marine Biology.
CH	ZOOL 146	Marine Ecology.
CH	ZOOL 186	Systems Ecology.
CH	ZOOL 213	Advanced Marine Ecology.

HYDROLOGY AND HYDROGEOLOGY

R	BAE (SSC) 671	Theory of Drainage—Saturated Flow.
R	BAE (SSC) 674	Theory of Drainage—Unsaturated Flow.
R	CE 383**/****	Water Resources Engineering I.
R	CE 580	Flow in Open Channels.
R	CE 644	Ground Water Engineering.
R	MEA 300****	Environmental Geology.
R	MEA 311****	Physical Climatology.
R	MEA 481	Principles of Geomorphology.
R	MEA 555	Meteorology of the Biosphere.
R	MEA 562	Applied Sedimentary Analysis.
R	MEA 565**	Hydrogeology.
R	MEA 566**	Hydrogeology of Groundwater Pollution and Protection.
R	MEA 567**	Geochemistry.
R	MEA 580	Remote Sensing.
R	SSC 511	Soil Physics.
CH	ENVR 281	Topics in Advanced Hydrology.
CH	GEOG 110	Meteorology.
CH	GEOG 112	Micrometeorology.
CH	GEOG 115	Climatology.
CH	GEOG 117	Soils.

<i>*Campus</i>	<i>Course</i>	<i>Title</i>
CH	GEOL 118	Sedimentation.
CH	GEOL 138	Geomorphology.
CH	GEOL 145	Principles of Geochemistry.
CH	GEOG 156	Natural Resources.
CH	GEOL 188 (MSCS 103)	Geological Oceanography.
CH	GEOL 225	Advanced Sedimentation.
CH	GEOL 253	Physical Geochemistry.
CH	MSCS 122	Physical Oceanography.
CH	MSCS 206	Seminar on Oceanography.

Requests for information regarding the water resources graduate programs should be directed to the Chairman of the Water Resources Committee, the departments represented on the Water Resources Committee or the Water Resources Research Institute, 124 Riddick Building, North Carolina State University, Raleigh, N. C. 27607.

*Courses bearing the prefix "R" are taught at Raleigh and those bearing "CH" at Chapel Hill. Unlisted courses can be substituted for listed courses with the approval of the student's advisory committee.

**Courses from which requirements for master's degree minor will normally be met. Substitutions can be made with approval of the student's advisory committee.

***Prerequisites can be waived for graduate students with water resources minor.

****Not graduate level courses.

Wood and Paper Science

GRADUATE FACULTY

Professor R. J. Thomas, Head

Professors: A. C. Barefoot Jr., H. Chang, E. B. Cowling, E. L. Ellwood, I. S. Goldstein, J. S. Gratzl, C. A. Hart, R. G. Hitchings, M. W. Kelly, M. P. Levi, H. G. Olf, R. G. Pearson; *Adjunct Professors:* L. L. Edwards, W. T. McKean Jr., R. P. Singh; *Professor Emeritus:* A. J. Stamm; *Associate Professors:* R. H. Cornell, T. W. Joyce, D. H. J. Steensen, E. A. Wheeler; *Adjunct Associate Professors:* T. K. Kirk, R. B. Phillips; *Associate Professor Emeritus:* C. G. Landes; *Research Associate:* C. L. Chen

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Graduate study programs leading to the Master of Science and the Doctor of Philosophy degrees are offered for students in a wide variety of areas in the field of wood and paper science. The Master of Wood and Paper Science is available for students who do not wish to emphasize research in their graduate study programs.

Because the field of wood and paper science is a derived science, considerable emphasis is placed upon developing a strong minor in the graduate program in any one or more of the supporting disciplines such as organic chemistry, polymer chemistry, chemical engineering, mathematics, statistics, biology, engineering mechanics, mechanical engineering, physics, economics or business administration.

Areas of study and research in pulp and paper science and technology cover wood and fiber chemistry, lignin and carbohydrate chemistry, pulping chemistry, pollution abatement processes, fiber and paper properties and paper coatings and additives. In wood science and technology, study and research areas include wood physics (especially wood liquid relations), wood chemistry, wood biology, wood mechanics and engineering, manufacturing processes, wood industry economics and marketing.

Modern facilities are completely equipped to conduct education and research in all forms of wood and fiber processing. Included are specialized laboratories for study of wood physics, wood anatomy, wood processing, wood engineering, wood chemistry, pulping, papermaking, paper testing and paper coating. Equipment available includes optical and electron microscopes, a range of spectrophotometers, gas and liquid chromatographs, ultracentrifuge, membrane osmometers, electron spin resonance, nuclear magnetic resonance apparatus weatherometer, molecular filtration equipment and excellent computer graphics facilities.

The prerequisite for graduate study in the department is an undergraduate degree in wood science, pulp and paper science or in related disciplines such as any of a number of branches of science or engineering.

SELECTED ADVANCED UNDERGRADUATE COURSES

WPS 403 Paper Process Analysis. *Preqs.: WPS 321, 322. 3(1-6) S.*

WPS 410 Pulp and Paper Systems Analysis and Control. *Preq.: WPS 322 or WPS 360. 3(3-0) F.*

WPS 413 Paper Properties and Additives. *Preq.: Sr. standing. 3(1-6) F.*

WPS 415 Project Management and Analysis I. *Preq.: Sr. standing in pulp and paper science technology. 2(2-0) F.*

WPS 416 Project Management and Analysis II. *Preq.: WPS 415. 2(2-0) S.*

WPS 434 Management Decision Making for Wood Products. *Preq.: EB 201 or EB 212. 3(3-0) S.*

WPS 441 Introduction to Wood Mechanics. *Preqs.: MA 212, PY 221 or 211. 3(3-0) F.*

WPS 442 Wood Mechanics and Structural Design. *Preq.: CE 211 or WPS 441. 3(2-3) S.*

WPS 471 Pulping Process Analysis. *Preq.: WPS 321. 3(1-6) F.*

FOR GRADUATES AND ADVANCED UNDERGRADUATES

WPS 513 Tropical Woods. *Preq.: WPS 202. 2(1-3) Alt. F.* Structure, identification, properties, characteristics and use of tropical woods, especially those used in plywood and furniture. Wheeler

WPS 515 Surface and Colloid Chemistry of Papermaking. *Preq.: CH 331 or CH 431. 3(3-0) S.* The fundamental principles of surface and colloid chemistry important in papermaking and their application to optimizing wet-end processes. The electrokinetic basis of flocculation, retention and other wet-end phenomena and the science of wet-end additives. Olf

WPS 521 Chemistry of Wood Polysaccharides. *Preqs.: CH 223 and WPS 332 or BCH 451. 3(3-0) Alt. F.* Fundamental chemistry and physical chemistry of monosaccharides and polysaccharides with emphasis on hemicellulose and cellulose. Topics include construction and configuration, stereochemistry, solution properties, molecular weight determination and reactivity.
Chang, Gratzl

WPS 522 Chemistry of Lignin and Extractives. *Preqs.: CH 223 and WPS 332 or BCH 451. 3(3-0) Alt. S.* A study of the biosynthetic pathways, structure and reactivity of lignin and wood extractives with emphasis on topics important to pulping and conversion to useful by-products.
Chang, Gratzl

WPS 525 Pollution Abatement in Forest Products Industries. *Preq.: Grad. or advanced undergrad. standing in science or engineering curricula. 3(3-0) S.* Pollution sources, implant control and treatment of water and air pollution in forest products with concentration on the pulp and paper industry.
Joyce

WPS 533 Advanced Wood Anatomy. *Preq.: WPS 202 or CI. 3(1-6) Alt. S.* Fundamental wood anatomy and cell wall ultrastructure. Laboratory techniques for light and electron microscopic studies of wood.
Wheeler

WPS 540 Wood Composites. *Preqs.: WPS 441; grad. or advanced undergrad. standing. 3(3-0) Alt. S.* This course is designed to acquaint advanced undergraduate and graduate students with the rapidly expanding field of wood composites. Production processes for particleboard, plywood, hardboard, fiberboard, and other wood composites are presented. Elastic theory for the stiffness, strength, and buckling resistance of composites will be developed. Test procedures for determining mechanical properties and design procedures for glued laminated members, panel products, and built-up members, including I- and box-beams, stressed-skin panels and sandwich panels, will be outlined.
Kelly, Pearson

WPS 560 Advanced Pulp and Paper Process Analysis. *Preqs.: WPS 321 and 322. 3(3-0) S.* Design and analysis of pulp and paper mill processes; process control applications in pulping, chemical recovery, bleaching and papermaking; principles of pulp mill chemical and energy recovery; and new alkaline pulping recovery technology.
Graduate Staff

WPS 591 Wood and Paper Science Problems. *Preq.: Sr. or grad. standing. Credits Arranged.* Assigned or selected problems in the field of silviculture, logging, lumber manufacturing, pulp technology or forest management.
Graduate Staff

WPS 599 Methods of Research in Wood and Paper Science. *Preq.: Advanced undergrad. or grad. standing. Credits Arranged.* Research procedures, problem outlines, presentation of results; consideration of selected studies by forest research organizations; sample plot techniques.
Graduate Staff

FOR GRADUATES ONLY

WPS 604 Timber Physics. *Preqs.: MA 212, PY 221, WPS 202. 3(3-0) Alt. F.* Density, specific gravity and moisture content variation affecting physical properties; physics of drying at high and low temperatures; thermal, sound, light and electrical properties of wood.
Hart

WPS 606 Wood Process Analysis. *Preq.: WPS 604. 3(3-0) F.* Analysis of wood processes through the solution of comprehensive problems involving the physics of temperature and moisture relations.
Graduate Staff

WPS 691 Graduate Seminar. *Preq.: Grad. standing. 1(1-0) F/S.* Presentation and discussion of progress reports on research, special problems and outstanding publications.
Graduate Staff

WPS 693 Advanced Wood and Paper Science Problems. *Preq.: Grad. standing. Credits Arranged. F.S.* Selected problems in the field of wood and paper science. Graduate Staff

WPS 699 Problems and Research. *Preq.: Grad. standing. Credits Arranged.* Specific problems that will furnish material for a thesis. Graduate Staff

Zoology

GRADUATE FACULTY

Professor J. G. Vandenberg, Head

Professors: G. T. Barthalmus, P. C. Bradbury, B. J. Copeland, D. S. Grosch, C. F. Lytle, G. C. Miller—*Graduate Administrator*, J. F. Roberts, D. E. Smith, *Professor (USDI):* M. T. Huish; *Adjunct Professors:* F. A. Cross, J. B. Funderburg, J. D. Hair, T. R. Rice; *Professors Emeriti:* D. E. Davis, W. W. Hassler, L. E. Mettler, T. L. Quay; *Associate Professors:* P. D. Doerr, W. C. Grant, J. M. Miller, S. C. Mozley, K. H. Pollock, L. A. Real, H. A. Underwood Jr., T. G. Wolcott; *Associate Professor (USDI):* J. H. Kerby; *Adjunct Associate Professors:* R. L. Ferguson, D. E. Hoss, G. R. Huntsman, C. S. Manooch III, L. W. Reiter, D. S. Peters, R. McL. Shelley, G. W. Thayer; *Assistant Professors:* B. L. Black, L. B. Crowder, D. J. DeMont, M. N. Feaver, R. M. Grossfeld, R. G. Hodson, R. A. Lancia, R. A. Powell, G. J. San Julian, J. R. Walters; *Adjunct Assistant Professor:* D. R. Colby

The Department of Zoology offers to qualified students the opportunity to earn the Master of Science and the Doctor of Philosophy degrees. Students may specialize in many areas: behavior, general ecology, population dynamics, limnology, marine biology, fisheries biology, wildlife biology, ecological life histories of parasites, morphology and systematics of vertebrates, cellular, reproductive and comparative physiology and endocrinology. For certain specialities, a master's degree without a thesis is available.

The department is located in Gardner Hall where facilities for research activities are available. Opportunity for many types of ecological studies is provided in the extensive natural areas of state parks, a 200 ha field research area 10 km from campus containing various types of vegetation and a pond, and at various private, state and federal laboratories associated with the department.

SELECTED ADVANCED UNDERGRADUATE COURSES

ZO 400 Biological Issues in Human Ecology. *Preq.: BS 100 or BS 105. 3(3-0) S.*

ZO 410 Introduction to Animal Behavior. *Preqs.: BS 100 and either ZO 201 or ZO 303. 3(3-0) F.*

ZO (BO) 414 Cell Biology. *Preqs.: CH 223, PY 212, ZO 201 or ZO 303. 3(3-0) S.*

ZO 415 Cellular and Animal Physiology Laboratory. *Coreq.: ZO 414 or ZO 421. 2(0-5) F,S.*

ZO 420 Fishery Science. *Preqs.: ZO 201 or ZO 303; ZO (BO) 360. 3(2-2) F.*

ZO 421 Vertebrate Physiology. *Preqs.: CH 223, PY 212, ZO 201 or ZO 303. 3(3-0) F,S,Sum.*

ZO (ENT) 425 General Entomology. *Preq.: ZO 201 or equivalent. 3(2-3) F,Sum.*

ZO 441 Ichthyology. *Preqs.: ZO 201 or ZO 303, jr. standing. 3(3-0) S.*

ZO 442 Ichthyology Laboratory. *Preq.: ZO 201 or 203; Coreqs.: ZO 441, jr. standing. 1(0-3) S.*

ZO 490 Special Topics in Zoology. 1-3.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

ZO 501 Ornithology. *Preqs.: ZO 323 or 303, ZO 421. 3(2-3) F.* The biology of birds: systematics, physiology, life histories, ecology and behavior. Walters

ZO (PHY) 503 General Physiology I. *3(3-0) F.* (See physiology.)

ZO (PHY) 504 General Physiology II. *3(3-0) S.* (See physiology.)

ZO (ST) 506 Sampling Animal Populations. *3(3-0) Alt. F.* (See statistics.)

ZO (ENT) 509 Ecology of Stream Invertebrates. *Preqs.: ZO 201 or 302, BO (ZO) 360 or equivalent. 4(2-6) S.* Introduction to stream ecology and analysis of animal communities. Lectures cover community structure and function, life histories of dominant animals, sampling design and techniques and responses to pollution. Laboratory exercises include field collections, identification of animals and quantitative research techniques. A personal collection of animals and a weekend field trip to mountain streams are required. Mozley

ZO 510 Animal Behavior Research Techniques. *Preqs.: ZO 410 or grad. standing in ZO, ST 311 or equivalent. 3(1-5) S.* Introduction to laboratory and field techniques used in animal behavior research. Course emphasizes modern methods of recording and analyzing behavioral data but also covers experimental manipulation of behavior by external stimuli and physiological alterations. Graduate Staff

ZO (PHY) 513 Comparative Physiology. *Preq.: ZO 421 or CI. 4(3-3) S.* A comparative study of the organ systems of vertebrates and the physiological processes involved in maintaining the homeostatic state. The various compensatory mechanisms employed during environmental stress are included. Graduate Staff

ZO (FW) 515 Growth and Reproduction of Fishes. *Preqs. or coreqs.: GN 411, ZO 420, 421, 441. 3(2-3) S.* The biology of fishes: physiology, anatomy, pathology, behavior and genetics. This course is designed especially for graduate students in fisheries. Several trips to research laboratories are taken. (Offered S 1984 and alt. years.) Huish

ZO 517 Population Ecology. *Preqs.: ZO (BO) 360 and ST 511 or equivalent. 3(3-0) S.* The dynamics of natural populations. Current work, theories and problems dealing with population growth, fluctuation, limitation and patterns of dispersion, species interactions, community structure and ecological genetics. Real

ZO (MEA) 520 Principles of Biological Oceanography. *3(3-0) S.* (See marine, earth and atmospheric sciences.)

ZO (PO) 524 Comparative Endocrinology. *4(3-3) S.* (See poultry science.)

ZO (GN) 532 Biological Effects of Radiations. 3(3-0) S. (See genetics.)

ZO (GN) 540 Evolution. 3(3-0) F. (See genetics.)

ZO 542 Herpetology. *Preqs.: ZO 323 or 303, ZO 421. 3(2-3) S.* The biology of the amphibians and reptiles: systematics, life history, anatomy, behavior, physiology and ecology.

Graduate Staff

ZO 544 Mammalogy. *Preq.: ZO 323 or ZO 303. 4(3-3) F.* The biology of mammals: evolution, functional morphology, reproduction, behavior, ecology, population biology, classification and identification. One weekend field trip is planned.

Powell

ZO (FW) 553 Principles of Wildlife Science. *Preq.: ZO (BO) 360. 3(2-3) F.* The principles of wildlife management and their application are studied in the laboratory and in the field.

Doerr

ZO (FW) 554 Wildlife Field Studies. *Preqs.: ZO 553, ST 311; CI. 3(2-3) S.* Field application of methods for studying vertebrate wildlife populations; sampling methods, data gathering, analysis and interpretation of results are practiced. Participation in field laboratories and one or two weekend field trips is required.

Doerr

ZO (MB) 555 Protozoology. *Preq.: CI. 4(2-6) S.* The biology of the Protozoa: lectures include morphology, physiology, ecology, genetics, reproduction, evolution, systematics and life-cycles of both free-living and parasitic taxa; laboratory will stress recognition of selected forms and demonstrate techniques used to prepare specimens for microscopic examination.

Bradbury

ZO (BO) 560 Principles of Ecology. *Preq.: Three semesters of college-level biology courses. 4(3-3) F.* A consideration of the principles of ecology at the graduate level. Each of the major subject areas of ecology is developed in sufficient depth to provide a factual and philosophical framework for the understanding of ecology.

Graduate Staff

ZO (PHY, ENT) 575 Physiology of Invertebrates. 3(3-0) S. (See physiology.)

ZO 581 Helminthology. *Preqs.: ZO 323 or 303, ZO 315 or equivalent. 4(2-4) F.* The study of the morphology, biology and control of parasitic helminths.

G. C. Miller

ZO (ENT) 582 Medical and Veterinary Entomology. 3(2-3) S. (See entomology.)

ZO (FW) 586 Aquaculture I. *Preqs.: ZO (BO) 360, sr. or grad. standing. 3(3-0) F.* The biological and general principles of aquaculture. Lectures emphasize the present status of aquaculture, species involved, techniques employed, and problems encountered. Recent advances in research and development are discussed and areas of future research and development are identified.

Lewis

ZO (FW) 587 Aquaculture I Laboratory. *Preqs.: ZO (BO) 360, sr. or grad. standing; Coreq.: ZO 586. 1(0-3) F.* Methods and techniques of cultivating aquatic organisms. Field trips and reports on local hatcheries and facilities are required. (Three to four overnight field trips will be taken on week days to coastal areas, state hatcheries, and private hatcheries; students are responsible for shared room costs and their meals. Four field trips will also be taken on laboratory day within driving range of Raleigh.)

Lewis

ZO 590 Special Studies. *Preqs.: Twelve hours ZO, CI. Credits Arranged. F,S.* A directed individual investigation of a particular problem in zoology, accompanied by a review of the pertinent literature. A maximum of three hours is allowed toward the master's degree.

Graduate Staff

ZO 592 Topical Problems. *Preq.: CI. 1-3 F.S.* Organized, formal lectures and discussion of a special topic.
Graduate Staff

ZO 593 Aquatic Ecology Seminar. *Preqs.: Grad., PBS or sr. standing; one course in aquatic, marine or fisheries areas. 1-3 F.S.* Presentations and discussions of recent research and topical issues in aquatic and marine sciences. Each student enrolled for credit must make at least one presentation.
Mozley

FOR GRADUATES ONLY

ZO 603 Advanced Parasitology. *Preq.: ZO 581. 3(2-3) S.* The study of the theoretical and practical aspects of parasitism; taxonomy, physiology and immunology of animal parasites.
G. C. Miller

ZO 614 Advanced Cell Biology. *Preq.: ZO (BO) 414 or equivalent. 3(3-0) S.* A study of the current problems of cell biology including the problems of the molecular organization and functions of membrane systems, subcellular organelles and specialized cells. (Offered 1984 and alt. years.)
Roberts, Smith

ZO 619 Advanced Limnology. *Preq.: ZO 419. 3(3-0) Alt. yrs.* Recent topics in limnological research. Lectures and discussion will draw from journal articles on physical, chemical and biological aspects, including nutrient control of productivity, predator control of community structure and determinants of water quality. A research paper or project is required.
Mozley

ZO 621 Fishery Science. *Preqs.: ST 511, ZO 420, a course in calculus. 3(2-3) F.* An analysis of fishery research methods. Population enumeration and dynamics. The relationship between fluctuations in natural populations and environmental factors. (Offered 1984 and alt. years.)
Graduate Staff

ZO (MEA) 623 Benthic Ecology. *3(3-0) Alt. S.* (See marine, earth and atmospheric sciences.)

ZO (MEA) 624 Ecology of Fishes. *3(3-0) F.* (See marine, earth and atmospheric sciences.)

ZO 644 Advanced Topics in the Study of Mammals. *Preq.: ZO 544. 3(2-3) S.* Current topics in the study of mammals with concentration each year on a different topic, such as community ecology, population biology, evolution or functional morphology. Student research projects required.
Powell

ZO (BO) 660 Advanced Topics in Ecology I. *4(3-3) S.* (See botany.)

ZO (BO) 661 Advanced Topics in Ecology II. *Preq.: ZO (BO) 560 or equivalent. 4(3-3) S.* Reports and seminar discussions of five major topics, such as secondary productivity, competitive exclusion, predator-prey and other interspecies relationships, regulation of populations, physiological ecology and management of resources. Some field trips. Laboratory provides experience in analysis of ecological systems, modeling and computer simulation. (Offered 1985 and alt. years.)
Graduate Staff

ZO 690 Seminar. *1(1-0) F.S.* The presentation and defense of original research and current literature.
Graduate Staff

ZO 691 Topics in Animal Behavior. *Preq.: ZO 510. 3(3-0) S.* Intensive examination of selected aspects of animal behavior and their relationship to physiology, ecology and other biological fields. May be repeated for credit when topic changes.
Graduate Staff

ZO 699 Research in Zoology. *Preqs.: Twelve semester credits in ZO and CI. Credits Arranged. F.S.* Graduate Staff

GRADUATE FACULTY*

NORTH CAROLINA STATE UNIVERSITY

- Abbas, Leon E., Visiting Assistant Professor of Recreation Resources Administration. Ph.D., Oregon State University.
- Abbate, Angelo Rudy, Associate Professor of Design. M.L.A., University of Pennsylvania.
- Abrams, Charlie Frank, Jr., Associate Professor of Biological and Agricultural Engineering. Ph.D., North Carolina State University.
- Adams, David Arthur, Associate Professor of Forestry and University Studies. Ph.D., North Carolina State University.
- Adams, William M., Professor of Food Animal and Equine Surgery; Associate Dean of Veterinary Medicine and Director of Veterinary Medical Services. V.M.D., University of Pennsylvania.
- Afify, Elsayed M., Professor of Mechanical and Aerospace Engineering. Ph.D., University of Michigan.
- Agrawal, Dharma Prakash, Associate Professor of Electrical Engineering. Ph.D., Federal Institute of Technology, Lausanne, Switzerland.
- Ahmad, Shuaib Haroon, Assistant Professor of Civil Engineering. Ph.D., University of Illinois.
- Alexander, Samuel Thomas, Assistant Professor of Electrical and Computer Engineering. Ph.D., North Carolina State University.
- Alexander, Winsor E., Professor of Electrical and Computer Engineering. Ph.D., University of New Mexico.
- Allen, Howard Lee, Jr., Assistant Professor of Forestry and Soil Science; Director of the Forest Fertilization Cooperative. Ph.D., North Carolina State University.
- Allen, Steven G., Associate Professor of Economics and Business. Ph.D., Harvard University.
- Altman, Richard S., Visiting Lecturer (part-time) in Design. M. Arch., Washington University.
- Alvarez, Raul Eduardo, Associate Professor of Industrial Engineering. M.S., North Carolina State University.
- Ambrose, John Thomas, Associate Professor of Entomology. Ph.D., Cornell University.
- Amein, Michael, Professor of Civil Engineering and Marine, Earth and Atmospheric Sciences. Ph.D., Cornell University.
- Amerson, Henry Van, Assistant Professor of Botany and Forestry. Ph.D., North Carolina State University.
- Amoozegar-Fard, Aziz, Assistant Professor of Soil Science. Ph.D., University of Arizona.
- Anderson, Charles Eugene, Professor of Botany. Ph.D., Purdue University.
- Anderson, Clifton A., Professor Emeritus of Industrial Engineering. Ph.D., Ohio State University.
- Anderson, Donald Benton, Professor Emeritus of Botany. Ph.D., Ohio State University.
- Anderson, James Michael, Assistant Professor (USDA) of Botany and Crop Science. Ph.D., Purdue University.
- Anderson, John R., Jr., Assistant Professor of Crop Science. Ph.D., University of Illinois.
- Anderson, Marshall W., Adjunct Professor of Biomathematics. Ph.D., University of Tennessee.
- Anderson, Norman Dean, Professor of Mathematics and Science Education. Ph.D., Ohio State University.

* Membership in the graduate faculty may be in either of two categories: (1) full status or (2) associate status. Full status permits a faculty member to engage in any and all phases of the graduate programs of the University. Associate members may teach courses at the graduate level and serve as chairmen of master's advisory committees.

- Anderson, Ruth D., Assistant Professor of Speech-Communications. Ph.D., University of Oregon.
- Andrews, Grover J., Associate Professor of Adult and Community College Education and Associate Vice Chancellor for Extension and Public Service. Ed.D., North Carolina State University.
- Ansari, Ashley, Assistant Professor of Food Animal and Equine Medicine. Ph.D., Michigan State University.
- Antonelli, Douglas Charles, Adjunct Associate Professor of Industrial Engineering. Ph.D., North Carolina State University.
- Apperson, Charles Smith, Associate Professor of Entomology. Ph.D., University of California at Riverside.
- Apple, Jay Lawrence, Professor of Genetics and Plant Pathology; Coordinator of International Programs. Ph.D., North Carolina State University.
- Arends, James Jay, Assistant Professor of Entomology. Ph.D., Oklahoma State University.
- Argenzio, Robert Alan, Professor of Anatomy, Physiological Sciences and Radiology. Ph.D., Cornell University.
- Armstrong, Carter Michael, Associate Professor of Physics. Ph.D., University of Maryland.
- Armstrong, Frank Bradley, University Professor of Biochemistry, Genetics and Microbiology. Ph.D., University of California at Berkeley.
- Armstrong, William Dwight, Associate Professor of Animal Science. Ph.D., Purdue University.
- Arnold, John F., Assistant Professor of Curriculum and Instruction. Ph.D., University of Connecticut.
- Aronson, Arthur L., Professor of Veterinary Anatomy, Physiological Sciences and Radiology and Head of the Department. Ph.D., University of Minnesota.
- Arya, Satya Pal Singh, Professor of Marine, Earth and Atmospheric Sciences. Ph.D., Colorado State University.
- Atkinson, Maxine P., Assistant Professor of Sociology and Anthropology. Ph.D., Washington State University.
- Aubrecht, Lyn G., Adjunct Assistant Professor of Curriculum and Instruction. Ph.D., Ohio State University.
- Aurand, Leonard William, Professor of Food Science and Biochemistry. Ph.D., Pennsylvania State University.
- Austin, William Wyatt, Jr., Professor Emeritus of Materials Engineering. Ph.D., Vanderbilt University.
- Averre, Charles Wilson, III, Professor of Plant Pathology. Ph.D., Purdue University.
- Axtell, Richard Charles, Professor of Entomology. Ph.D., Cornell University.
- Aycock, Robert, Professor of Plant Pathology and Horticultural Science; Head of the Department of Plant Pathology. Ph.D., North Carolina State University.
- Ayoub, Mahmoud Amin, Professor of Industrial Engineering. Ph.D., Texas Technological University.
- Babcock, Willard Farrington, Professor Emeritus of Civil Engineering. S.M., Massachusetts Institute of Technology.
- Bach, Walter Debele, Jr., Adjunct Associate Professor of Marine, Earth and Atmospheric Sciences. Ph.D., University of Oklahoma.
- Bacheler, Jack S., Associate Professor of Entomology. Ph.D., University of Florida.
- Bachmann, Klaus Jurgen, Professor of Chemistry. Ph.D., Freie Universitat, Berlin, West Germany.
- Bailey, Jack Eugene, Assistant Professor of Plant Pathology. Ph.D., Michigan State University.
- Bailey, John Albert, Professor of Mechanical and Aerospace Engineering and Graduate Administrator. Ph.D., University College of Swansea.
- Baines, Barbara Joan, Associate Professor of English. Ph.D., Ohio University.
- Baird, Jack Vernon, Extension Professor of Soil Science and Specialist in Charge. Ph.D., Washington State University.
- Baker, James Robert, Associate Professor of Entomology. Ph.D., University of Kansas.

- Balik, Charles Maurice, Assistant Professor of Chemical Engineering and Materials Engineering. Ph.D., Case Western Reserve University.
- Ball, Brenda Combs, Adjunct Associate Professor of Psychology. Ph.D., University of North Carolina at Chapel Hill.
- Ball, David Stafford, Associate Professor of Economics and Business. Ph.D., University of North Carolina at Chapel Hill.
- Ball, Hershell Ray, Jr., Associate Professor of Food Science. Ph.D., University of Missouri.
- Ballard, Russell, Adjunct Associate Professor of Forestry and Director of the Forest Fertilization Cooperative. Ph.D., University of Florida.
- Ballas, Lawrence M., Assistant Professor of Anatomy, Physiological Sciences and Radiology. Ph.D., Cornell University.
- Ballenger, William L., Visiting Lecturer of Educational Leadership and Program Evaluation. Ph.D., North Carolina State University.
- Ballinger, Walter Elmer, Professor of Horticultural Science. Ph.D., Michigan State University.
- Ballington, James Ralph, Associate Professor of Horticultural Science. Ph.D., North Carolina State University.
- Banker, James Roderick, Associate Professor of History. Ph.D., University of Rochester.
- Bao, Han; Assistant Professor of Industrial Engineering. Ph.D., University of New South Wales, Sydney, Australia.
- Barclay, William John, Professor Emeritus of Electrical and Computer Engineering. Ph.D., Stanford University.
- Barker, David Arthur, Assistant Professor of Marine, Earth and Atmospheric Sciences. Ph.D., University of Wisconsin.
- Barefoot, Aldos Cortez, Jr., Professor of Wood and Paper Science and University Studies. D.F., Duke University.
- Barker, James Albert, Adjunct Assistant Professor of Forestry. Ph.D., North Carolina State University.
- Barker, James Cathey, Extension Associate Professor of Biological and Agricultural Engineering. Ph.D., University of Tennessee.
- Barker, Kenneth Reece, Professor of Plant Pathology and Graduate Coordinator. Ph.D., University of Wisconsin.
- Barker, Roger Lee, Associate Professor of Textile Materials and Management. Ph.D., Clemson University.
- Barkley, Key Lee, Professor Emeritus of Psychology. Ph.D., University of North Carolina at Chapel Hill.
- Barnes, Donald Warren, Jr., Associate Professor of Architecture. Ph.D., Texas A&M University.
- Barnes, Harold John, Professor of Food Animal and Equine Medicine. Ph.D., Ahmadu Bello University, Zaira, Nigeria.
- Barrax, Gerald W., Assistant Professor of English. M.A., University of North Carolina at Chapel Hill.
- Barrett, James R., Assistant Professor of History. Ph.D., University of Pittsburgh.
- Barrick, Elliott Ray, Professor Emeritus of Animal Science. Ph.D., Purdue University.
- Barthalmus, George Timothy, Professor of Zoology. Ph.D., Pennsylvania State University.
- Bartholomew, William Victor, Professor Emeritus of Soil Science. Ph.D., Iowa State University.
- Barwick, Allen J., Adjunct Assistant Professor of Industrial Engineering. Ph.D., North Carolina State University.
- Batchelor, Peter, Professor of Architecture. M.C.P., University of Pennsylvania.
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HISTORY OF THE UNIVERSITY

The University of North Carolina is comprised of all the public institutions of higher education in North Carolina that confer degrees at the baccalaureate level or higher. The University was authorized by the State Constitution in 1776, and it was chartered in 1789 by the General Assembly.

The University of North Carolina opened its doors to students at Chapel Hill in 1795. Thereafter, beginning in the latter part of the nineteenth century, the General Assembly of North Carolina has established and supported fifteen other public senior institutions in keeping with Article IX, Section 8, of the Constitution of North Carolina which provides that the "General Assembly shall maintain a public system of higher education, comprising The University of North Carolina and such other institutions of higher education as the General Assembly may deem wise."

By 1969, The University of North Carolina included six constituent institutions, governed by a single Board of Trustees. This multi-campus University had its beginnings in legislation enacted in 1931 that defined The University of North Carolina to include The University of North Carolina at Chapel Hill, North Carolina State University at Raleigh, and The University of North Carolina at Greensboro. In the 1960's three additional campuses were added: The University of North Carolina at Charlotte, The University of North Carolina at Asheville, and The University of North Carolina at Wilmington.

Beginning in 1877, the General Assembly of North Carolina established or acquired ten additional separately governed state-supported senior institutions of higher education. They are: Appalachian State University, East Carolina University, Elizabeth City State University, Fayetteville State University, North Carolina Agricultural and Technical State University, North Carolina Central University, North Carolina School of the Arts, Pembroke State University, Western Carolina University, and Winston-Salem State University. Then, in 1971, the General Assembly redefined The University of North Carolina, and under the terms of that legislation all sixteen public senior institutions became constituent institutions of The University of North Carolina.

The constitutionally authorized Board of Trustees of the six-campus University of North Carolina was designated the Board of Governors and this body is by law The University of North Carolina. The Board of Governors consists of thirty-two members elected by the General Assembly, and it is charged with "the general determination, control, supervision, management, and governance of all affairs of the constituent institutions." The chief executive officer of The University is the President.

Each constituent institution of The University has its own faculty and student body. The chief administrative officer of each institution is the chancellor, and the chancellors are responsible to the President.

Each constituent institution also has a board of trustees composed of thirteen members: eight elected by the Board of Governors, four appointed by the Governor, and the elected president of the student body *ex officio*. (The School of the Arts has two additional *ex officio* trustees.) The principal powers of these institutional boards are exercised under a delegation of authority from the Board of Governors.

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NORTH CAROLINA STATE UNIVERSITY



Access Key

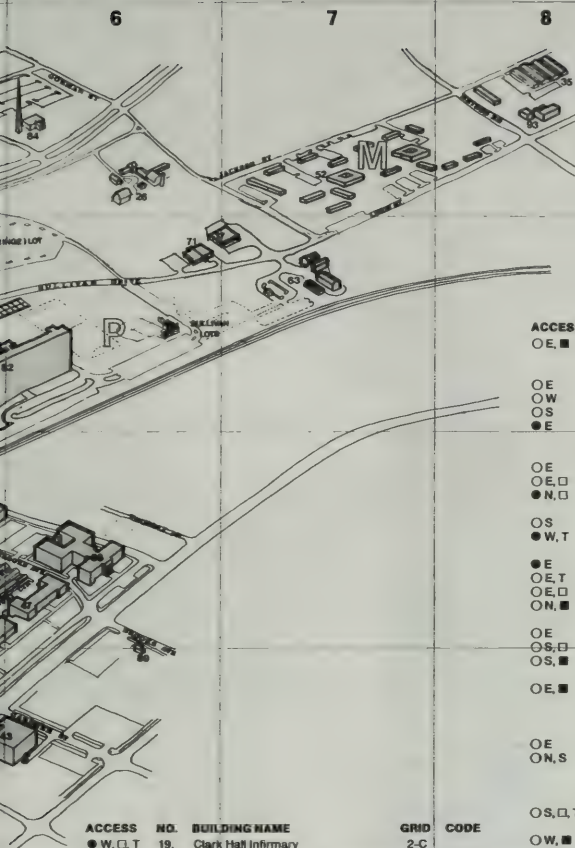
- can be entered by an individual in a wheelchair with no assistance.
- can be entered by an individual in a wheelchair with minimum assistance.

N, S, E, W,—indicates side of building with accessible entrance.

□ passenger elevator.

■ freight elevator.

T accessible toilet.



ACCESS	NO.	BUILDING NAME	GRID	CODE
● W, □, T	19.	Clark Hall Infirmary	2-C	
○ S, ■	20.	Clark Laboratories	5-D	
○ N, □	21.	Con Hall	4-D	
○ N, T	22.	Cultural Center	5-D	
○ N, □	23.	Dabney Hall	4-D	
● W, ■	24.	Daniels Hall	4-C	
● W, □, T	25.	McKinnon Extension Continuing Education Center	5-F	
○ N	26.	Farm Unit 5	6-F	
	27.	Field House	2-C	
○ S, ■	28.	Fraternity Court	4-F	
● N, □, T	29.	Gardner Hall	5-D	
	30.	Boston Hall	5-D	
	31.	Gold Residence Hall	2-C	
	32.	Greenhouse—Agronomy	5-D	
	33.	Greenhouse—Biological Sciences	5-D	
	34.	Greenhouse—Horticulture	5-D	
	35.	Greenhouse—840 Method Rd.	8-F	
	36.	Greenhouse—Plant Pathology	5-D	
	37.	Erinella Animal Health Lab	5-E	
	38.	Harrison Hall	5-D	
● N, □, T	39.	Harris Hall	5-D	
○ W, □	40.	D. H. Hill Library—Original Wing	5-C	
○ W, □, T	41.	D. H. Hill Library—Book Stack Tower	5-C	
○ N, S, □	42.	D. H. Hill Library—Erdahl-Cloyd Wing	5-C	
● N, □, T	43.	Hillsborough Building	5-C	
○ W	44.	Hodges Wood Products Lab	4-E	
	45.	Holladay Hall	2-B	
	46.	Information Center, Visitor Parking	2-B	
○ S, ■	47.	Kilgore Hall	6-D	
	48.	Laundry	3-C	
	49.	Leazar Hall	3-B	
	50.	Lee Residence Hall	5-E	
● S, □	51.	Mann Hall	4-C	
	52.	E. S. King Village (17 Apt. Bldgs. A-D)	7-F	
	53.	Memorial Tower	3-A	
	54.	Metcalf Residence Hall	4-D	
● S	55.	Morris Building	3-C	

ACCESS	NO.	BUILDING NAME	GRID	CODE
○ E, ■	56.	Nelson Textile Building	6-D	N
	57.	1911 Building	4-C	
	58.	Owen Residence Hall	4-D	
○ E	59.	Page Hall	3-C	PA
○ W	60.	Park Shops	3-C	PS
○ S	61.	Patterson Hall	4-C	PT
● E	62.	Peelo Hall	3-B	
	63.	Physical Plant Maint. Center	7-E	
○ E, □	64.	Physical Plant Shops (Armory)	4-D	
● N, □	65.	Phytotron	5-D	PHY
	66.	Poe Hall	3-C	POE
○ S	67.	Polk Hall	4-C	PK
○ S	68.	Power Plant	3-C	
● W, T	69.	Price Music Center	4-D	PMC
● E	70.	Primrose Hall	3-B	
○ E, T	71.	Print Shop/University Graphics	6-E	
○ E, □	72.	Quad, Snack Bar	2-C	
○ N, ■	73.	Wm. Neal Reynolds Coliseum	3-D	
	74.	Ricks Hall	4-C	RI
	75.	Riddick Engineering Labs	3-C	RD
○ E	76.	Riddick Stadium	3-C	
○ S, □	77.	Robertson Wing, Blitmore Hall	4-E	
○ S, ■	78.	Schaub-Food Science Building	4-E	SFS
	79.	Scott Hall	5-D	SC
○ E, ■	80.	Steam Plant	4-E	
	81.	Students Supply Store	4-D	
	82.	Sullivan Residence Hall	6-E	
	83.	Syme Residence Hall	2-C	
○ E	84.	Television Center	6-F	TVS
○ N, S	85.	Thompson Theater/Craft Center	2-C	TT
	86.	Tompkins Hall	3-B	T
	87.	Tucker Residence Hall	4-D	
	88.	Turlington Residence Hall	4-D	
	89.	Turner House	6-C	
○ S, □, T	90.	University Student Center	3-B	USC
○ W, ■	91.	Watauga Hall	2-B	
	92.	Weaver Laboratories	5-E	DSW
	93.	Weed Control Laboratories	8-F	
○ S, ■	94.	Welch Residence Hall	2-C	
○ N, S	95.	Williams Hall	5-D	WMS
○ E, ■	96.	Winston Hall	4-B	WN
● E, □	97.	Withers Hall	4-C	WI
	98.	(John Yancey) N. Residence Hall	3-A	

	COURTS AND FIELDS	GRID
A.	Bagwell-Becton-Berry Quad	2-C
B.	Gold-Welch-Syme-Brooks Court	2-C
C.	Holladay Hall Court	3-B
D.	Court of North Carolina	3-B
E.	Gardner Arboretum	4-C
F.	University Plaza (Brickyard)	5-C
G.	University Student Center Plaza	4-D
H.	Turlington-Alexander Court	4-D
J.	Tucker-Owen Court	4-D
K.	Lee-Sullivan-Bragaw Court	5-E
L.	Fraternity Court	4-F
M.	E. S. King Village Court	7-F
N.	Paul H. Darr Track	2-D
O.	Miller Fields	4-E
P.	Doak Field	6-E
Q.	McKinnon Center Court	5-F

	PARKING LOTS	GRID
	Brooks Ave. Lot	6-C
	Carnegie Hall Lot	3-D
	Coliseum Bays	3-D
	East Coliseum Lot	2-C
	Friendly Drive Lot	6-D
	Harris Lot	4-E
	Hillsborough Building Lots	6-C
	Parking Deck	2-C
	Riddick Lot	3-C
	Sullivan Lots	6-E
	West Lot	6-E
	Yarbrough Lot	3-C

CODE

BI

BS

A

BR

BU

CG

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9



North Carolina State University Bulletin
The Graduate School
Box 7102

Raleigh, North Carolina 27695-7102

Second Class Postage Paid at
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